- RECORD #2318 DETAIL

First Name :	Brad
Last Name :	Stewart
Business Name :	Vice President and Provost
Address :	Montgomery College
City :	
State :	MD
Zip Code :	
Email Address :	
Submission Content/Notes :	
Attachments :	Stewart_Brad.pdf (111 kb)

Testimony in Support of the Proposed Purple Line Offered to the Maryland Transportation Administration

Brad Stewart, Vice President and Provost, Montgomery College
November 22, 2008

Good Afternoon. I am Brad Stewart, Vice President and Provost here at Montgomery College. On behalf of our faculty, staff and students, I want to welcome you and the members of the audience to the Takoma Park/Silver Spring Campus. Thank you for the opportunity to testify in support of the proposed Purple Line transit proposal.

The mission of Montgomery says that students are the center of our universe and that we change their lives by providing a wide variety of quality educational programs and academic support to everybody who comes through our doors. Everybody gets a chance here. To paraphrase Bruce Springsteen, we work hard everyday to "close the gap between American reality and the American Dream". The Purple Line will help us do that for even more residents of Montgomery County and the National Capital Region.

Now you might just be thinking to yourself that's quite a claim even for a former college professor turned administrator. Well, here's how the Purple will help MC change lives:

First, the Purple Line will make it easier and faster to get to the TP/SS campus by bringing Metro access much closer to our campus. Students will spend less time in transit and more time attending classes, studying, using our computer labs and our library consulting with our academic advisors, doing volunteer work in the community, and receiving support from our tutoring and study center staff. It will also make it easier to get to work and to get home to spend time with their families.

Second, the Purple Line will provide access to huge network of educational options after (and even during) their time at MC. More than half of the students who enter MC intend to transfer to a four-year college and university and earn a bachelors degree. The largest recipient of MC transfer students is the University of Maryland at College Park and the Purple Line will provide a direct transit link to that campus.

Third, the Purple Line will help provide access for our students to the other campuses of Montgomery College and the more than 60 programs offered the nine University of Maryland System institutions located at the Universities at Shady Grove. It will also allow our students quicker and easier access to jobs and internships at the firms located in the Biotechnology Corridor in the Shady Grove area.

In sum, the Purple Line will help open up numerous educational opportunities to the residents of Montgomery County. At its core, the Purple Line is an extremely important economic development and workforce creation project. Please build it as soon as possible so we can more effectively close the gap between American Reality and the American Dream.

Thank you.

- RECORD #1221 DETAIL

First Name :	Vice-President/Provost Brad
Last Name :	Stewart
Business Name :	Montgomery College
Address :	
City :	
State :	MD
Zip Code :	
Email Address :	

Submission Content/Notes : Brad Stewart, B-R-A-D, S-T-E-W-A-R-T. Good afternoon everyone. On behalf of the faculty, staff and students of Montgomery College, welcome to the Takoma park Silver Spring campus and thank you for this opportunity to testify in support of light rail for the purple line.

The mission of Montgomery College says that students are the center of our universe and that we change their lives by providing a wide variety of quality educational programs and academic support to everyone who comes through our doors.

Everyone gets a chance here at Montgomery College. To paraphrase what Bruce Springsteen said about Barack Obama, we work every day to close the gap between American reality and the American dream.

The purple line will help us do that for even more residents of Montgomery County and the national capital region.

You might be thinking to yourself, wow, that's quite a claim even for a college professor turned administrator. Well, here's how the purple line will help us change lives.

First, the purple line will make it easier and faster to get to the Takoma Park Silver Spring campus by bringing the Metro access much closer to us. Students will spend less time in transit, more time attending classes, studying, using our computer labs and our library, consulting with academic advisors, doing volunteer work in the community, receiving support from our tutoring and study staff, study center staff, and everyone else at the college who helps them succeed.

It will make it easier for them to get to work after school or before school, and it will make it easier for them to get home and spend time with their families.

Second, the purple line will provide access to a huge network of educational options after and even during their time at Montgomery College.

More than half the students that enter MC intend to transfer to a 4-year college or university, earn a Bachelors degree and beyond. The largest recipient of MC transfer students is the University of Maryland at College Park, and the purple line will provide a direct transit link to that campus.

It will in effect marry the Takoma Park Silver Spring campus of Montgomery College to the University of Maryland at College Park. Not a shotgun wedding, but a great wedding of convenience.

Third, the purple line will provide access to our students to the other campuses of Montgomery College and the more than 60 programs offered by nine University of Maryland system institutions located at the universities at Shady Grove.

It will also allow our students quick and easy access to jobs and internships at the firms located in the biotechnology corridor in the Shady Grove area.

In sum, the purple line will open up numerous educational opportunities to the residents of Montgomery County.

At its core, the purple line is an extremely important economic development workforce creation project. Please build it as soon as possible so that we can more effectively close the gap between American reality and the American dream. Thank you.

- RECORD #2218 DETAIL

First Name :	Georgette
Last Name :	Godwin
Business Name :	Montgomery County Chamber of Commerce
Address :	
City :	
State :	MD
Zip Code :	
Email Address :	
Submission Content/Notes :	
Attachments :	Wrttn Tstmny. G.Godwin.MCCC.pdf (2 mb) Goodwin_GiGi.pdf (185 kb)

The Voice of Montgomery County Business

JAMES WHANG, CHAIRMAN
GEORGETTE "GIGI" GODWIN, PRESIDENT & CEO

Maryland Transit Administration

Testimony of Georgette "Gigi" Godwin, President and CEO
Montgomery County Chamber of Commerce

Good Evening. I am Gigi Godwin, President of the Montgomery County Chamber of Commerce. Thank you for the opportunity to testify tonight in support of the Purple Line. The business community supports those transportation projects that do the most to relieve congestion, promote economic development, and contribute to the long term economic and environmental vibrancy and sustainability of our community.

For these reasons the Montgomery County Chamber of Commerce supports Light Rail **critical component of attracting and retaining high tech employers and high tech jobs. And, finally, a Light Rail Purple Line will provide the missing link in our regional transit connectivity.**

Therefore, we urge the selection of a Light Rail mode along the Georgetown Branch Alignment

For businesses and their employees, time is money, and the only way these employees will use the system is if they know they can rely on it to get them to their destination, whether it be work, school, or daycare, in a predictable and short period of time.

Economic Development Benefits

Economic Development along the Purple Line's East/West corridor will prove to be a major benefit of the transit project. Many stations have been identified as opportunities for economic development including Chevy Chase Lakes, and the Takoma/Langely area, which is part of a joint master plan between Montgomery and Prince George's Counties. This kind of economic development is consistent with both Montgomery County and State of Maryland Strategy for transit oriented development that creates environmentally friendly pedestrian communities. Light rail is preferable to Bus Rapid Transit because of the fixed investment by government in the infrastructure, which gives potential buyers of property, both business and residential, a confidence that property will continue to appreciate because of proximity to the light rail station.

Regional Connectivity

The Purple Line plays a critical role in connecting our region's outdated transportation system – a system based primarily on assumptions of employee's work habits and commuter patterns that were true 30 years ago, but have drastically changed in the past three decades. As our economy has changed, so too has our workforce, and the way we work. A purple line light rail link is CRITICAL to ensuring new regional connectivity. This new regional connectivity will allow our community to continue to grow and thrive in our new, diverse, growing economy.

Thank you for the opportunity to get the Montgomery County Chamber of Commerce's comments regarding the AA/DEIS on the record. We look forward to working with the MTA to make this project a reality.

The Voice of Montgomery County Business

JAMES WHANG, CHAIRMAN
GEORGETTE "GIGI" GODWIN, PRESIDENT & CEO

Maryland Transit Administration

Testimony of Georgette "Gigi" Godwin, President and CEO
Montgomery County Chamber of Commerce

Good Evening. I am Gigi Godwin, President of the Montgomery County Chamber of Commerce. Thank you for the opportunity to testify tonight in support of the Purple Line. The business community supports those transportation projects that do the most to relieve congestion, promote economic development, and contribute to the long term economic and environmental vibrancy and sustainability of our community.

For those reasons, the Montgomery County Chamber of Commerce supports a Light Rail **Purple Line. We believe that this is the best long term investment that the Maryland and Federal Transit Administrations could make in our community. A Light Rail Purple Line will provide a reliable, efficient and environmentally sound mode of transportation for our employees, our students and all our citizens. A high quality mode of transportation is a critical component of attracting and retaining high tech employers and high tech jobs. And, finally, a Light Rail Purple Line will provide the missing link in our regional transit connectivity.**

Therefore, we urge the selection of a Light Rail mode along the Georgetown Branch Alignment as the locally preferred alternative.

Reliability and Efficiency
In order for a new transit system to improve the convenience and connectivity of those who ride it everyday, it must be reliable and efficient. It must provide significant decreases in travel times via car and it must be able to reliably deliver on those promises for decreased travel times. The Light Rail options outlined in the DEIS significantly outperform the Bus Rapid Transit (BRT) options in both reliability and efficiency.

Given that both the low and medium BRT systems would use shared lanes and existing roadways, reliability of these systems decrease as traffic continues to increase, with those buses stuck in the same traffic as the cars on the road, offering commuters no incentive to leave their cars and use the Purple Line. Light rail, however, with its faster speeds and dedicated right of way along the Georgetown branch trail, offers significant efficiency AND reliability, with travel times of 9 minutes from Bethesda to Silver Spring as opposed to the 25 minutes the Bus Rapid Transit system would offer.

For businesses and their employees, time is money, and the only way these employees will use the system is if they know they can rely on it to get them to their destination, whether it be work, school, or daycare, in a predictable and short period of time.

Economic Development Benefits

Economic Development along the Purple Line's East/West corridor will prove to be a major benefit of the transit project. Many stations have been identified as opportunities for economic development including Chevy Chase Lakes, and the Takoma/Langely area, which is part of a joint master plan between Montgomery and Prince George's Counties. This kind of economic development is consistent with both Montgomery County and State of Maryland Strategy for transit oriented development that creates environmentally friendly pedestrian communities. Light rail is preferable to Bus Rapid Transit because of the fixed investment by government in the infrastructure, which gives potential buyers of property, both business and residential, a confidence that property will continue to appreciate because of proximity to the light rail station.

Regional Connectivity

The Purple Line plays a critical role in connecting our region's outdated transportation system – a system based primarily on assumptions of employee's work habits and commuter patterns that were true 30 years ago, but have drastically changed in the past three decades. As our economy has changed, so too has our workforce, and the way we work. A purple line light rail link is CRITICAL to ensuring new regional connectivity. This new regional connectivity will allow our community to continue to grow and thrive in our new, diverse, growing economy.

Thank you for the opportunity to get the Montgomery County Chamber of Commerce's comments regarding the AA/DEIS on the record. We look forward to working with the MTA to make this project a reality.

- RECORD #1342 DETAIL

First Name :	GiGi
Last Name :	Godwin
Business Name :	Montgomery County Chamber of Commerce
Address :	St Momoc Street
City :	Rockvile
State :	MD
Zip Code :	20850
Email Address :	

Submission Content/Notes : My name is Gigi Godwin, G-I-G-I, Godwin, G-O-D-W-I-N. I am the president of the Montgomery County Chamber of Commerce. Thank you for the opportunity to testify tonight in support of the Purple Line.

The business community supports those transportation projects that do the most to relieve congestion, promote economic development and contribute to the long-term economic and environmental vibrancy and sustainability of our community. For those reasons, the Montgomery County Chamber of Commerce supports a light rail Purple Line.

We believe that this is the best long- term investment that the Maryland and Federal Transit Administrations could make in our community. A light rail Purple Line will provide a reliable, efficient, and environmentally sound mode of transportation for our employees, our students, and all our citizens. A high quality mode of transportation is a critical component of attracting and retaining high-tech employers and high-tech jobs. And finally, a light rail Purple Line will provide the missing link in our regional transit connectivity.

Therefore, we urge the selection of a light rail mode along the Georgetown Branch alignment as the locally preferred alternative. So the three key factors: reliability and efficiency. The light rail options outlined in the DEIS significantly outperform the bus rapid transit options in both reliability and efficiency. Given that both the low and medium BRT systems would use shared lanes at existing roadways, reliability of these systems decrease as traffic continues to increase with those buses stuck in the same traffic as the cars on the road, offering commuters no incentive to leave their cars and use that type of Purple Line. Light rail, however, with its faster speeds and dedicated right-of-way along the Georgetown Branch Trail offers significant efficiency and reliability with travel times of 9 minutes from Bethesda to Silver Spring as opposed to the 25 minutes the bus rapid transit system would offer.

For businesses and their employees, time is money. And the only way these employees will use the system is if they know they can rely on it to get them to their destination whether it be work, school or daycare in a predictable and short period of time.

Key factor number two, economic development benefits. Many stations have been identified as opportunities for economic development, including Chevy Chase lakes in the Tacoma Langley area which is part of the joint Master Plan between Montgomery and Prince George's counties. This kind of economic development is consistent with both the Montgomery County and state of Maryland's strategy for transit oriented development that creates environmentally friendly pedestrian communities. Light rail is preferable to bus rapid transit because of the fixed investment by government in the infrastructure which gives potential buyers of property both business and residential a confidence that property will continue to appreciate because of proximity to the light rail station.

And finally, regional connectivity. Thank you very much.

- RECORD #5 DETAIL

First Name :	James
Last Name :	Carlson
Business Name :	Montgomery County Commuter Services
Address :	8401 Colesville Rd
City :	Silver Spring
State :	MD
Zip Code :	20910
Email Address :	james.carlson@montgomerycountymd.gov
Submission Content/Notes :	Would like an electronic copy of the May 31st public briefing (Power Point) given at Discovery Communications in Silver Spring. Thanks

- RECORD #3284 DETAIL

First Name :	Gary
Last Name :	Johnson
Business Name :	Montgomery County DOT
Address :	100 Edison Park Drive
City :	Gaithersburg
State :	MD
Zip Code :	20878
Email Address :	gary.johnson@montgomerycountymd.gov
Submission Content/Notes :	I'm the Project Manager for the County's Silver Spring Green Trail along Wayne Avenue. Can I please get an update on the Purple Line and how it will afftect the Green Trail. Thank You

- RECORD #3340 DETAIL

First Name :	Eric
Last Name :	Engelberg
Business Name :	Maryland Department of Planning-Property Mappng Section for Montgomery County
Address :	SDAT Montgomery County Office, 30 W. Gude Dr.
City :	Rockville
State :	MD
Zip Code :	20850
Email Address :	eengelberg@mdp.state.md.us
Submission Content/Notes :	Is there a map of the "Locally Preferred Alternative" route like the one on your web site that you can mail me? Thank you.

- RECORD #1185 DETAIL

First Name :	President Charlene
Last Name :	Dukes
Business Name :	Prince Georges Community College
Address :	
City :	
State :	MD
Zip Code :	
Email Address :	
Submission Content/Notes :	I am the President of Prince George's Community College. I want to thank you for the opportunity to represent the college this evening and our students and employees who rely on public transit. Prince George's Community College enrolls approximately 40,000 students, 40,052 this year. We offer more than 100 programs of study, and we employ 1,000 full time and 1,500 part time employees. We have extension centers throughout Prince George's County at the University Town Center in Hyattsville, Laurel College Center in Laurel, the Skill Trade Center in Camp Springs and Andrews Air Force Base. In addition to providing quality education for our students, our mission is to make education affordable and accessible. To that end, while we support the purple line and like the speakers before me, we want you to start in New Carrollton, but we don't want you to end there. We urge you in your next phase to consider a proposed route that would include Prince George's Community College. There is limited access for Metro, bus and rail travelers to the campus. In 2005, roughly 3/4 of our student body reported getting to class by vehicle rather than using public transportation. The time that students spent commuting to class appears to be increasing over the years. The proposed purple line will connect the major central business districts and activity centers of Bethesda, Silver Spring, Takoma and Langley Park, College Park, University of Maryland and New Carrollton. While the current proposal already includes a direct link to the state's flagship university in Prince George's County, we recommend that in the future, you consider connections to Prince George's Community College. There is a large population that relies on public transit and many residents in the county who choose or have to take public transit instead of driving to our main campus. So we want to urge you to consider this alternate route as your next priority as you phase the purple line through in Prince George's County. Thank you very much for the opportunity to speak.

- RECORD #1212 DETAIL

First Name :	Victor
Last Name :	Weissberg
Business Name :	Department of Public Workers & Transportation
Address :	9400 Peppercone Place
City :	Largo
State :	MD
Zip Code :	20774
Email Address :	

Submission Content/Notes : It's Victor Weissberg, V-I-C-T-O-R W-E-I-S-S-B-E-R-G. Good afternoon. I'm Victor Weissberg of the Prince George's County Department of Public Works and Transportation.

I would like to thank Governor O'Malley, Secretary Porcari for their leadership and commitment to this project of regional and national significance. On behalf of the Department I would like to express our strong support for the Purple Line from Bethesda to New Carrollton and to do so as Light Rail.

While the major transportation corridors in our region have been built along the traditional spokes of the wagon wheel, radiating from the core, the actual growth patterns have been and continue to be much different. Numerous communities in the inner suburbs have grown in to mini cities. Yet, transportation connecting these centers has been woefully insufficient.

We agree that the purpose and need of the Draft Environmental Impact Statement, that the Purple Line would serve east-west transit patrons which currently are not served by a fixed guide-way option.

Building roads and relying on vehicle-based modes of transportation alone will not solve the problem. We need a comprehensive approach and that means the Purple Line as Light Rail will be a tremendous first step.

The Purple Line is critical in addressing the need to help connect the existing WMATA Rail System together, the Orange Line in New Carrollton, the Green Line in College Park, and the two spokes of the Red Line in Montgomery County.

Therefore, it is also vital that we connect to the existing network of not just Metrorail but MARC College Park, New Carrollton, and Silver Spring and AMTRAK's northeast corridor in New Carrollton.

The Purple Line is essential and only as light rail will it truly meet the needs of our communities for the 21st century and serve as the catalyst for the type of economic development and environmentally prudent growth that we all strive for.

In a region where we cannot continue down the path of sprawl, the Purple Line in Prince George's County will provide the ideal synergy for expanding the economic engine of the region at locations like Langley Park, College Park at East Campus, and M Square as well as New Carrollton, just to mention some of the burgeoning opportunities that await.

As the DEIS shows the ridership exists, there will be fewer vehicles on the road, commute times will be significantly reduced. Therefore, the time is now to build the Purple Line and to build it as Light Rail.

We continue to work with the MTA on design details which require additional effort and frankly are not quite up to par with the level of detail that has been put forth for the Montgomery County section. The Department will be submitting more detailed written comments to the DEIS, for the record, prior to the January 14, 2009 deadline. Thank you very much for the opportunity to speak this morning.

- RECORD #2872 DETAIL

First Name :	Victor
Last Name :	Weissberg
Business Name :	Prince George's County
Address :	
City :	
State :	MD
Zip Code :	
Email Address :	VWEISSBERG@CO.PG.MD.US

Submission Content/Notes : Please find comments to the DEIS for the Purple Line from Prince George's County attached and below. Thank you.

January 13, 2009

Diane Ratcliff
Director of Planning

Maryland Transit Administration
6 St. Paul Street, 9th Floor
Baltimore, MD 21202

Dear Ms. Ratcliff:

Serving as the Special Assistant to the Director of Prince George's County's Department of Public Works and Transportation (DPW&T), I am providing comments on behalf of the county regarding the Purple Line Draft Environmental Impact statement (DEIS). First and foremost, Prince George's County strongly supports construction of the Purple Line as a Light Rail Transit (LRT) system from New Carrollton to Bethesda. It is imperative that the best possible project is built from the start, and this means the high option light rail, as designated in the DEIS for the Prince George's portions of the alignment. The Purple Line is a project vital for this county, its citizens and residents, as it will provide increased access and mobility, reduced travel times, and help spur economic development. However, there must be equity in the reduction of impacts throughout the alignment, not just in particular areas, as well as in design concepts and project amenities.

As correctly stated in the DEIS Purpose and Need, the Purple Line would serve east-west transit patrons currently not served by a fixed-guideway option. Building new roads and relying on vehicle based modes of transportation, alone, will not solve traffic congestion problems. The Purple Line as LRT will be an important step towards a more sustainable, long-term approach in addressing the region's transportation needs. The Purple Line will also connect the existing WMATA rail system together – the Orange Line in New Carrollton, the Green Line in College Park and the two spokes of the Red Line in Montgomery. In addition, it is essential that we also provide greater connectivity to MARC at College Park, New Carrollton and Silver Spring, as well as AMTRAK's Northeast Corridor in New Carrollton. We cannot continue on a path of sprawl in this region. The Purple Line will provide the necessary synergy for expansion of the economic engine of the region at locations including, but not limited to, Langley Park, College

Park – East Campus and M-Square, and New Carrollton.

Only as LRT, will the Purple Line truly meet the needs of the diverse communities along this route. It will provide faster service, the ability to attract a greater ridership, reduce the largest number of single occupancy vehicle trips, and provide higher capacity. Consequently, we believe that the Purple will have better long-term value and effectiveness, and will assist in maximizing economic development. According to the DEIS, the medium LRT would generate 62,600 daily boardings compared to 51,800 for medium Bus Rapid Transit (BRT). The ride between the University of Maryland Campus and Bethesda would be 34 minutes for medium LRT, as compared to 49 minutes for medium BRT. In addition, medium LRT would result in at least 4,000 new transit trips relative to the No Build Alternative, as compared to the medium BRT.

Prince George's County firmly believes that it is essential the best possible project must be built. Consequently, Prince George's County will support only the Purple Line constructed to New Carrollton, phases constructed under a deferred basis. In fact, Prince George's County strongly encourages the Maryland Transit Administration (MTA) to begin construction of the Purple Line at New Carrollton and then working west to Bethesda.

MTA has proposed that the alignment travel in a shared lane on Paint Branch Parkway going under the CSX Bridge. Prince George's County has and continues its strong opposition to a shared lane and requests that a dedicated lane for any alignment on Paint Branch Parkway be provided. If the project does not provide a dedicated lane, road maintenance for Paint Branch Parkway from US Route 1 to River Road should revert to State Highway Administration (SHA).

Throughout the alignment, Prince George's County supports any new fixed-guideway transit to travel dedicated lanes rather than in shared lanes. This will provide for faster travel times, and well as a better defined project. With regard to impacts to drainage and stormwater management systems, any impact to stormwater management structures or systems must be fully addressed, and restored to being in complete compliance with county standards and regulations.

A potential site for a light rail maintenance facility has been identified in Prince George's County. Final resolution of this site should be

concluded between MTA and the Maryland-National Capital Park and Planning Commission (M-NCPPC).

We are concerned about the level of design included in the DEIS. The portions in Prince George's County are, on the whole, significantly less than for other segments of the alignment. In addition, Prince George's County must be assured that the level of design and amenities, as well as efforts to reduce impacts are no less than in segments of the alignment outside of the county. Furthermore, the county assumes that design elements not included in the DEIS will still be fully explored and included in the final plans. Examples of where the MTA has not studied elements in detail, in Prince George's County are as follows:

- Dedicated lane use for transit on Paint Branch Parkway.
- Construction of a new CSX Bridge.
- Aerial crossing of the Kenilworth Avenue (MD201) and East-West

Highway/Riverdale Road (MD410) Intersection. (This is a concept that was developed by students at the University of Maryland and should be explored further. In general, there needs to be significantly more emphasis on the design of the alignment at intersections in Prince George's County).

Alignment on the south side of MD 410 from 58th Avenue to Veterans Parkway. (While not in the DEIS, MTA staff and representatives had indicated that such an option would be studied and could be accommodated). Based on this information, Prince George's County encouraged further study. However, more recently, MTA has suggested that only the option that would operate in turning lanes (in the DEIS as the

high option) would be the option considered, due to the level of impacts. This is an example of the confusion resulting from an alignment not being fully studied before inclusion in the DEIS.

Better integration of the proposed Takoma/Langley Park Transit Center with the Purple Line is needed.
Classification of design elements do not appear to be consistent. (A BRT/LRT separated grade crossing (two bridges) at Connecticut Avenue is listed as a medium element, yet a grade separation crossing on Annapolis Road is considered only as a high element even with favorable topographic conditions).
More in-depth study of potential noise impacts on surrounding

communities and mitigation techniques that can be utilized should be performed. Concerns raised by the Hanson Oaks community serve as another example of the need for greater attention to the design in minimizing impacts to communities in Prince George's County. We request that the MTA further investigate design features that can help reduce impacts to this and other affected communities.
Consideration of added design elements to the Prince George's County portion such as bike/pedestrian facilities, grass tracks and other amenities afforded to the Montgomery County portion should be given.
Design of the New Carrollton Station must accommodate future extension of the Purple Line as a one seat ride to Largo and beyond. (If the Ellin Road option is the preferred alternative, provision of an off-road bus layover location should be incorporated).

The FTA looks to determine state/ local commitment by inclusion in the Region's Constrained Long Range Plan (CLRP). Currently, the Purple Line segment from New Carrollton to Silver Spring is not in the CLRP. The lack of inclusion in the CLRP should not hinder the ability for the Prince George's County portion of the alignment to move forward as a part of or as the initial segment of the Purple Line to be constructed.

In summary, Prince George's County strongly encourages the timely advance of the Purple Line into the FTA's funding process and ultimately into construction. It is critical for this county and the region for the Purple Line to be built as LRT for the reasons stated herein. Please do not hesitate to contact me at 301.883.5600 if you have any questions.

Sincerely,

Victor Weissberg

Special Assistant to the Director

Attachments : PG County.pdf (199 kb)

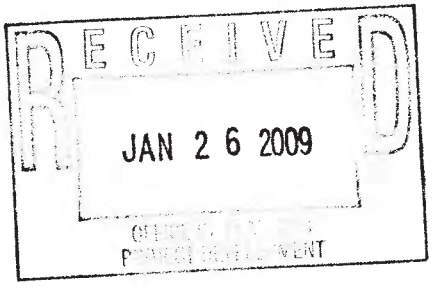
Jack B. Johnson
County Executive

PRINCE GEORGE'S COUNTY GOVERNMENT

DPWT

Department of Public Works and Transportation
Office of the Director

January 13, 2009



Diane Ratcliff
Director of Planning
Maryland Transit Administration
6 St. Paul Street, 9th Floor
Baltimore, MD 21202

Dear Ms. Ratcliff:

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As correctly stated in the DEIS Purpose and Need, the Purple Line would serve east-west transit patrons currently not served by a fixed-guideway option. Building new roads and relying on vehicle based modes of transportation, alone, will not solve traffic congestion problems. The Purple Line as LRT will be an important step towards a more sustainable, long-term approach in addressing the region's transportation needs. The Purple Line will also connect the existing WMATA rail system together – the Orange Line in New Carrollton, the Green Line in College Park and the two spokes of the Red Line in Montgomery. In addition, it is essential that we also provide greater connectivity to MARC at College Park, New Carrollton and Silver Spring, as well as AMTRAK's Northeast Corridor in New Carrollton. We cannot continue on a path of sprawl in this region. The Purple Line will provide the necessary synergy for expansion of the economic engine of the region at locations including, but not limited to, Langley Park, College Park – East Campus and M-Square, and New Carrollton.

Only as LRT, will the Purple Line truly meet the needs of the diverse communities along this route. It will provide faster service, the ability to attract a greater ridership, reduce the largest number of single occupancy vehicle trips, and provide higher capacity. Consequently, we believe that the Purple will have better long-term value and effectiveness, and will assist in

maximizing economic development. According to the DEIS, the medium LRT would generate 62,600 daily boardings compared to 51,800 for medium Bus Rapid Transit (BRT). The ride between the University of Maryland Campus and Bethesda would be 34 minutes for medium LRT, as compared to 49 minutes for medium BRT. In addition, medium LRT would result in at least 4,000 new transit trips relative to the No Build Alternative, as compared to the medium BRT.

Prince George's County firmly believes that it is essential the best possible project must be built. Consequently, Prince George's County will support only the Purple Line constructed to New Carrollton, phases constructed under a deferred basis. In fact, Prince George's County strongly encourages the Maryland Transit Administration (MTA) to begin construction of the Purple Line at New Carrollton and then working west to Bethesda.

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Throughout the alignment, Prince George's County supports any new fixed-guideway transit to travel dedicated lanes rather than in shared lanes. This will provide for faster travel times, and well as a better defined project. With regard to impacts to drainage and stormwater management systems, any impact to stormwater management structures or systems must be fully addressed, and restored to being in complete compliance with county standards and regulations.

A potential site for a light rail maintenance facility has been identified in Prince George's County. Final resolution of this site should be concluded between MTA and the Maryland-National Capital Park and Planning Commission (M-NCPPC).

We are concerned about the level of design included in the DEIS. The portions in Prince George's County are, on the whole, significantly less than for other segments of the alignment. In addition, Prince George's County must be assured that the level of design and amenities, as well as efforts to reduce impacts are no less than in segments of the alignment outside of the county. Furthermore, the county assumes that design elements not included in the DEIS will still be fully explored and included in the final plans. Examples of where the MTA has not studied elements in detail, in Prince George's County are as follows:

- Dedicated lane use for transit on Paint Branch Parkway.
- Construction of a new CSX Bridge.
- Aerial crossing of the Kenilworth Avenue (MD201) and East-West Highway/Riverdale Road (MD410) Intersection. (This is a concept that was developed by students at the University of Maryland and should be explored further. In general, there needs to be significantly more emphasis on the design of the alignment at intersections in Prince George's County).

- Alignment on the south side of MD 410 from 58th Avenue to Veterans Parkway. (While not in the DEIS, MTA staff and representatives had indicated that such an option would be studied and could be accommodated). Based on this information, Prince George's County encouraged further study. However, more recently, MTA has suggested that only the option that would operate in turning lanes (in the DEIS as the high option) would be the option considered, due to the level of impacts. This is an example of the confusion resulting from an alignment not being fully studied before inclusion in the DEIS.
- Better integration of the proposed Takoma/Langley Park Transit Center with the Purple Line is needed.
- Classification of design elements do not appear to be consistent. (A BRT/LRT separated grade crossing (two bridges) at Connecticut Avenue is listed as a medium element, yet a grade separation crossing on Annapolis Road is considered only as a high element even with favorable topographic conditions).
- More in-depth study of potential noise impacts on surrounding communities and mitigation techniques that can be utilized should be performed. Concerns raised by the Hanson Oaks community serve as another example of the need for greater attention to the design in minimizing impacts to communities in Prince George's County. We request that the MTA further investigate design features that can help reduce impacts to this and other affected communities.
- Consideration of added design elements to the Prince George's County portion such as bike/pedestrian facilities, grass tracks and other amenities afforded to the Montgomery County portion should be given.
- Design of the New Carrollton Station must accommodate future extension of the Purple Line as a one seat ride to Largo and beyond. (If the Ellin Road option is the preferred alternative, provision of an off-road bus layover location should be incorporated).

The FTA looks to determine state/ local commitment by inclusion in the Region's Constrained Long Range Plan (CLRP). Currently, the Purple Line segment from New Carrollton to Silver Spring is not in the CLRP. The lack of inclusion in the CLRP should not hinder the ability for the Prince George's County portion of the alignment to move forward as a part of or as the initial segment of the Purple Line to be constructed.

In summary, Prince George's County strongly encourages the timely advance of the Purple Line into the FTA's funding process and ultimately into construction. It is critical for this county and the region for the Purple Line to be built as LRT for the reasons stated herein. Please do not hesitate to contact me at 301.883.5600 if you have any questions.

Sincerely,

Victor Weissberg
Special Assistant to the Director

cc: David J. Byrd, Deputy Chief Administrative Officer
Samuel J. Parker, Jr., Chair, Prince George's County Planning Board, M-NCPPC
Fern V. Piret, Director, Department of Planning, M-NCPPC
Ronnie Gathers, Director, Department of Parks and Recreation, M-NCPPC
Haitham A. Hijazi, Director, DPW&T
Paul Wiedefeld, Administrator, MTA
J. Rick Gordon, Acting Deputy Director, DPW&T
Andre' Issayans, Deputy Director, DPW&T
Paivi E. Spoon, Special Assistant to the DCAO
Michael Madden, Project Manager, MTA
James E. Raszewski, Chief, Transit Division, DPW&T
Eric Foster, Supervisor, Transportation Planning Section, M-NCPPC
Harold Foster, Transportation Planning Coordinator, M-NCPPC

Jack B. Johnson
County Executive

PRINCE GEORGE'S COUNTY GOVERNMENT

DPW&T

Department of Public Works and Transportation
Office of the Director

MEMORANDUM

Date: January 9, 2009

To: Beverly G. Warfield, Special Assistant for Regulatory Affairs, Environmental Services Division, DER

From: Haitham A. Hijazi, Director

Re: TSM-A-95 Clearinghouse Review - Purple Line
MD 20081016-1012

The Department of Public Works and Transportation (DPW&T) has reviewed the above referral and has the following comments:

Prince George's County strongly supports the Purple Line project. However, to fully serve the needs of its citizens and residents, the County feels that the project must use Light Rail as the preferred alternative. Light Rail has the greater ability to provide faster service, attract increased ridership, reduce the largest number of single occupancy vehicle trips, provide higher capacity and; therefore, better long-term value and effectiveness and maximum economic benefit.

While Maryland Transit Administration (MTA) officials say that there is no intent to construct the Purple Line in phases, they do frequently point out that the College Park to New Carrollton segment has the lowest projected ridership. Prince George's County will only support the Purple Line with local funding if it is constructed to New Carrollton and not under a deferred basis.

The MTA has made clear they desire an alignment in a shared lane on Paint Branch Parkway going under the CSX Bridge. DPW&T has expressed opposition to a shared lane and has said that if the MTA does not provide a dedicated lane, road maintenance for Paint Branch Parkway from US 1 to River Road should become the responsibility of the State Highway Administration (SHA).

A potential site for a light rail maintenance garage has been identified in Prince George's County. Final resolution of this site should be concluded between MTA and the Maryland-National Capital Park and Planning Commission (MNCPPC). The County should be awarded full local match funding for all relevant costs involved in transferring this site to MTA and relocating the MNCPPC maintenance garage.

We are concerned about the level of design included in the DEIS for the segment in Prince George's County and note that a significant gap in design exists when compared to the segment in Montgomery County. A few examples of MTA not studying elements in detail nor including Prince George's County in the DEIS are as follows:

- Dedicated lane use for transit on Paint Branch Parkway and a new CSX Bridge.
- An aerial crossing of the intersection of Kenilworth Avenue (MD 201) and East-West Highway/Riverdale Road (MD 410).
- Dedicated lane use along the south side of MD 410 from 58th Avenue to Veterans Parkway.
- A more equitable cost and benefit distribution for each segment and a more even environmental mitigation measure distribution.
- Classification of design elements do not appear to be consistent. For example, a BRT/LRT separated grade crossing on Connecticut Avenue is listed as a medium element, yet a grade separation crossing on Annapolis Road is considered only as a high element even with favorable topographic conditions.

Greater consideration of added design elements to the Prince George's County portion like bike/pedestrian facilities, grass tracks and other amenities as have been afforded to the Montgomery County portion should be given.

Design of the New Carrollton Station must be done in a fashion to accommodate a future extension of the Purple Line as a one seat ride to Oxon Hill.

The FTA looks to determine state/local commitment by project inclusion in the Region's Constrained Long Range Plan (CLRP). Currently, the Purple Line segment from Silver Spring to New Carrollton is not in the CLRP. We understand that it is important for inclusion prior to the selection of a Locally Preferred Alternative (LPA), which is scheduled to take place in a couple of months. This exclusion in the CLRP should not prevent the Prince George's County segment to move forward as a part of or as the initial segment of the Purple Line to be constructed.

If you have further questions regarding the above, please contact Franklin Bell, Transit Planning Section, at (301) 883-5656.

HAH/VW/dc

cc: J. Rick Gordon, Acting Deputy Director
Vic Weissberg, Special Assistant to the Director
James Raszewski, Chief, Transit Division
Franklin A. Bell, Transit Planning Section

MD20081016-1012

Introduced By: Councilmember Wright

Resolution No. 2008 -86

Resolution Recommending Funding the Purple Line Medium Investment Light Rail Transit Alternative

WHEREAS, the State of Maryland has completed studying the alignment and mode alternatives for the Purple Line and has written the Alternatives Analysis/Draft Environmental Impact Statement; and

WHEREAS, the State of Maryland, with input from the community, city and county governments, and elected officials, will be deciding which mode and alignment and phasing of three projects the State may request funding for: the Purple Line, the Corridor City Transitway and/or the Baltimore Red Line; and

WHEREAS, fiscal, environmental, and economic sustainability are goals of the City of Takoma Park; and

WHEREAS, a livable community that is vibrant, healthy, and safe with convenient transportation for all of its residents is also a goal of the City; and

WHEREAS, the Purple Line, as proposed, would have three stops near Takoma Park that will serve residents, improve access to local businesses and provide an incentive for transit-oriented development: one at Arliss Street and Piney Branch Road ("Arliss Street"), one at University Boulevard and Gilbert Street ("Gilbert Street"), and one at University Boulevard and New Hampshire Avenue ("Takoma/Langley Crossroads"); and

WHEREAS, the population living in the vicinity of the proposed Purple Line is more transit dependent than other areas in Montgomery County; and

WHEREAS, the Purple Line would directly connect many transit dependent residents in Montgomery County and Prince George's County with important regional employment centers including New Carrollton, the University of Maryland, Silver Spring and Bethesda; and

WHEREAS, the Purple Line would also connect residents to the Metrorail Red, Green and Orange Lines; the MARC Brunswick, Camden and Penn Lines; Amtrak; and regional and intercity bus lines; allowing convenient access throughout the region; and

WHEREAS, there are many bus riders along the proposed Purple Line route whose commute time will become shorter, increasing their quality of life and expanding their employment opportunities; and

WHEREAS, the Takoma Park City Council has long supported light rail transit as the mode most beneficial for Takoma Park residents and business owners; and

WHEREAS, light rail transit may be provided in short train configurations allowing for much greater ridership capacity than bus rapid transit, which is provided by single car vehicles; and

WHEREAS, the estimated average travel time between Bethesda and Adelphi will be 31 minutes for the medium investment light rail Purple Line alternative and 40 minutes for the medium investment bus rapid transit Purple Line alternative; and

WHEREAS, the medium investment bus rapid transit alternative will share travel lanes to a much greater extent than the medium investment light rail alternative, and will therefore be more susceptible to delays due to traffic congestion; and

WHEREAS, residents of the Washington, D.C. region are comfortable with, and heavy users of, the area's existing rail transit system, and have a positive image of rail transit; and

WHEREAS, it is in the community's interest to invest in a light rail transit system, since it would allow for high ridership capacity and is faster and less subject to disruption than a bus rapid transit system; and

WHEREAS, installation of light rail infrastructure provides a clear signal to commercial property owners and investors of a permanent commitment to a transit route and station, encouraging investment in, and redevelopment of, properties adjacent to a light rail station, while bus rapid transit routes and stations are more easily moved, thus adding risk to commercial investment decisions; and

WHEREAS, the proposed light rail Purple Line will spur redevelopment of commercial properties in Takoma Park's priority redevelopment areas; and

WHEREAS, the Takoma Park Master Plan, approved and adopted in December 2000, recommends "tree-lined sidewalks, landscaped medians, and street trees in wide panels separating sidewalks from traffic" and "on-road bikeways and 'shared use paths' (8-foot to10-foot wide sidewalks) on both sides" of streets; and

WHEREAS, ample, shaded sidewalks separated from fast moving traffic by street trees would substantially improve transit rider access to the proposed Purple Line; and

WHEREAS, bicycle lanes would substantially improve the multi-modal connectivity of Takoma Park residents and businesses with other centers in our region; and

WHEREAS, the existing right-of-way and State Highway streetscape requirements only allow for a limited width of sidewalk with no trees or buffer and the plans for the Purple Line rely on the State Highway requirements; and

WHEREAS, greater right-of-way should be provided for so that there is enough room that sidewalks may be safe, comfortable, and inviting; and

WHEREAS, the addition of the proposed Purple Line will widen University Boulevard and Piney Branch Road roadbed by an additional minimum 20 feet of paved surface; and

WHEREAS, widening University Boulevard will make it more difficult for pedestrians to cross to the transit station and area businesses, and will take land from adjacent property owners; and

WHEREAS, careful review of the design of University Boulevard may result in alternative lane configurations or other creative design solutions that would reduce the amount of right-of-way needed, especially at the University Boulevard/New Hampshire Avenue intersection; and

WHEREAS, the areas around the proposed stops at Arliss Street, Gilbert Street, and Takoma/Langley Crossroads, are the foci of intensive revitalization efforts; and

WHEREAS, the tens of thousands of residents living near the proposed stops at Arliss Street, Gilbert Street and Takoma/Langley Crossroads are sorely in need of beautification, streetscape amenities, and facilities to improve public space and to allow people to walk to public transit in comfort; and

WHEREAS, these existing and new residents, shoppers, and businesses would greatly benefit from the beautification option of grass along the transit line tracks ("grass tracks"); and

WHEREAS, grass tracks will reduce storm water run-off into sensitive waterways, including Long Branch and Sligo Creek; and

WHEREAS, the land uses along the proposed Purple Line route include many amenities such as housing, employment, services, and retail and entertainment outlets, and the area has a substantial capacity for higher density mixed-use development near the proposed transit stops; and

WHEREAS, even with transit improvements, there is a need for more parking in the Takoma/ Langley Crossroads shopping and residential areas; and

WHEREAS, on-street parking is extremely important to the viability of street-facing commercial enterprises in transit-oriented mixed-use shopping districts; and

WHEREAS, in some of the Purple Line alternatives, parking will be lost in side lanes along University Boulevard; and

WHEREAS, the proposed Purple Line route along University Boulevard is a key east-west route linking residential areas with employment centers and transit stations in Montgomery and Prince George's County; and

WHEREAS, University Boulevard is already substantially congested and is destined to become even more congested over time as the region grows; and

WHEREAS, the low-investment Purple Line alternatives would not provide exclusive transit lanes and would have slower service and little incentive for residents to choose transit over a car; and

WHEREAS, the high-investment Purple Line alternatives would elevate the train or bus, creating walls that would divide communities on either side of University Boulevard without providing substantial travel time savings; and

WHEREAS, the medium investment bus rapid transit Purple Line alternative would not run in an exclusive lane, but would share the outside lane of University Boulevard with local buses, requiring the bus rapid transit vehicle to move into the adjoining traffic to pass the local buses picking up passengers at local stops; and

WHEREAS, the medium investment bus rapid transit alignment's use of the outside lane would preclude the use of this lane for future off-peak parking; and

WHEREAS, the medium investment light rail transit Purple Line alternative would operate in an exclusive lane, so that even when vehicle lanes are congested, the light rail vehicles would not be delayed, providing a substantial incentive for transit use; and

WHEREAS, the medium investment light rail transit alignment is in the center lanes of University Boulevard, allowing the outside lane to be used for off-peak parking; and

WHEREAS, all six of the alternatives are projected to meet the cost-effectiveness requirement of the Federal Transit Administration for funding through the New Starts program; and

WHEREAS, the light rail medium investment alternative has the second highest rating of Annual User Benefit (in hours) of the six alternatives, while having significantly lower capital costs than the alternative with the highest User Benefit; and

WHEREAS, the medium investment light rail alternative would reduce the region's Year 2030 daily vehicle trips by 17,253 and daily vehicle miles traveled by 183,603, while the medium investment bus rapid transit alternative would reduce the daily vehicle trips by 14,137 and 113,562, respectively; and

WHEREAS, development of the full Purple Line route from Bethesda to New Carrollton will provide the greatest access for Takoma Park residents to the region's existing transportation systems; and

WHEREAS, use of the Georgetown Branch right-of-way between Connecticut Avenue and the Bethesda Metro greatly reduces the amount of time it would take Takoma Park residents to reach Bethesda, since the travel time for this segment using the right-of-way would range from 2.4 to 5.5 minutes, based on the alternative chosen, as compared to 10.7 minutes if the right-of-way is not used; and

WHEREAS, of the six alternatives presented, the light rail transit medium investment alternative will provide the most efficient, convenient, safe, and healthy transportation and will do the best job of improving the fiscal, environmental and economic health of Takoma Park and our inner beltway region of the State of Maryland.

NOW, THEREFORE, BE IT RESOLVED THAT the City Council of the City of Takoma Park

1. Strongly urges the State to proceed with the submission of the full length of the Purple Line transit way to the Federal Transit Administration and to work for its funding and construction in the near term.

2. Strongly urges the Secretary of Transportation to select the medium investment light rail transit option as the Purple Line alternative to submit to the Federal Transit Administration.

3. Urges the provision for future installation of sidewalks of a width that maximizes pedestrian safety and mobility, shaded by trees and buffered from traffic along University Boulevard; either by taking, by easement or by voluntary acquisition of right-of-way, as appropriate.

4. At the same time, urges study of alternative lane configurations or other design solutions to minimize the amount of right-of-way needed to be taken from adjacent properties along University Boulevard.

5. Urges the use of grass tracks in areas such as Takoma/Langley Crossroads and Long Branch and urges the adoption of strict maintenance schedules for these green areas.

6. Urges the provision of on-street parking during non-peak periods in areas where it can be accomplished safely within the existing right-of-way, to support retail activities in adjacent properties.

7. Urges the Secretary of Transportation to work with the State Highway Administration to develop transit areas that will allow continued access to commercial properties in current development and future redevelopment via existing or future streets, intersections, curb cuts, left turn opportunities and traffic signals, while maintaining safety standards for pedestrians, bicyclists and automobiles; and urges the continuation of coordination and communication among the different governmental entities so the strongest possible plan emerges.

8. Expresses appreciation to the State of Maryland and the Maryland Transit Administration for the thorough and high-quality work that has been done by their staffs and consultants in planning the Purple Line transit way.

9. Expresses appreciation to the Executives and Councils of Montgomery County and Prince George's County for their strong support of the Purple Line transit way.

10. Urges the governments of Montgomery County and Prince George's County to support the medium investment light rail alternative of the Purple Line as the alternative that best serves the residents, institutions and businesses of the two counties now and in the long term.

Adopted this 17th day of November, 2008.

Attest:

Jessie Carpenter
City Clerk

- RECORD #3020 DETAIL

First Name :	Fern V.
Last Name :	Piret
Business Name :	Prince George's County Planning Department
Address :	14741 Governor Oden Bowie Drive
City :	Upper Marlboro
State :	MD
Zip Code :	20772
Email Address :	
Submission Content/Notes :	
Attachments :	PG County Planning Department.pdf (574 kb)

THE MARYLAND-NATIONAL CAPITAL PARK AND PLANNING COMMISSION

Prince George's County Planning Department
Office of the Planning Director

14741 Governor Oden Bowie Drive
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(301) 952-3595
D8-101001

January 28, 2009

Ms. Diane Ratcliff, Director
Office of Planning
Maryland Transit Administration
6 Saint Paul Street
Baltimore, Maryland 21202-1614

RE: Purple Line Alternatives Analysis and DEIS
Request for Draft Environmental Impact Statement
Comments

Dear Ms. Ratcliff:

Thank you for providing the Prince George's County Planning Department with the opportunity to comment on the *Purple Line Alternatives Analysis and Draft Environmental Impact Statement*. The Department's comments are attached. Please note that these comments do not reflect the position of the Prince George's County Planning Board or that of the Prince George's County Government. We look forward to continuing our excellent working relationship with your administration and the Maryland Department of Transportation on this critical public transportation project in Prince George's County.

Should you need additional information on our comments, please contact Harold Foster, Planner Coordinator, at 301-952-4947 or Harold.Foster@ppd.mncppc.org.

Sincerely,

Fern Piret

Fern V. Piret
Planning Director

Attachment

cc: Ronnie Gathers, Director, Prince George's County Department of Parks and Recreation
William R. Hite, Jr., Ph.D., Interim Superintendent, Prince George's County Public Schools
Haitham Hijazi, Director, Department of Public Works & Transportation
Vanessa Akins, Chief, Community Planning North
John Funk, Chief, Countywide Planning Division
Ivy Lewis, Chief, Community Planning South
Ragaei Abdelfattah, Planning Supervisor, Northeast Section, Community Planning North
Eric Foster, Supervisor, Transportation Planning
CJ Lammers, Supervisor, Environmental Planning
Maria Martin, Supervisor, Special Projects
Gail Rothrock, Supervisor, Historic Preservation
Harold Foster, Planner Coordinator, Transportation Planning
William Washburn, Planner Coordinator, Community Planning North
Chad Williams, Planner Coordinator, Community Planning North
Paivi Spoon, Office of the County Executive

Prince George's County Planning Department Staff Comments
Purple Line Alternatives Analysis (AA) and Draft Environmental Impact Statement (DEIS)

The following comments reflect staff review of the AA/DEIS, or are staff conclusions about the Purple Line in Prince George's County based on departmental work with the MTA Purple Line Project Team and the Bi-County Purple Line Task Force.

The MTA AA/DEIS for the Purple Line covers a broad range of subject areas. In their review of the AA/DEIS, staff concurs with MTA that in most of these subject areas there are no consequential environmental, social or other impacts in or on Prince George's County. There are, however, some core planning, design, and engineering detail challenges (CPDED) raised to date by this department and the county's Department of Public Works and Transportation (DPW&T) to which MTA has yet to provide definitive solutions. (See below.)

A. Environmental

Staff preliminarily concur with the AA/DEIS conclusions concerning Purple Line impacts in Prince George's County on ***Air Quality, Habitat and Wildlife, Rare and Endangered Species, Groundwater and Hydrology, Surface Water, Scenic and Wild Rivers, Floodplain and Waters of the United States, Topography, Geology, Soils and Hazardous Materials***.

However a more detailed review will be needed before the final environmental impact statement (FEIS) can be completed and preliminary engineering commenced on the locally preferred alternative (LPA). Further, staff recommends that the LPA should adhere to the following "performance envelope" criteria for minimizing or mitigating adverse environmental impacts in Prince George's County.

a. Any build alternative should utilize the alignment that results in the least impacts.

b. The system should utilize existing rights-of-way and stream crossings.

c. Where the alignment traverses existing 100-year floodplain and wetland areas, the crossings should be designed to minimize fill to the fullest extent possible.

d. Any areas impacted by temporary stormwater management structures to treat and convey runoff during the construction process should be fully restored.

e. Staging areas should be set up in existing areas outside of wooded and other regulated areas.

f. For anticipated stream crossings, the design should first seek to take advantage of existing stream crossings if possible. For anticipated stream crossings, culverts should be avoided and bridges that minimize impacts to stream habitat are encouraged.

g. All stormwater management should provide 100% quality control of stormwater runoff.

h. With regard to ***Noise and Vibration*** impacts, MTA indicates (particularly if light rail is the selected mode of operation) that there will be potentially significant noise and vibration generated in the vicinity of the light duty S&I facility at North Glenridge.

There is insufficient information in the AA/DEIS as written on specifically how MTA proposes to minimize or mitigate this noise and vibration, beyond their indication that noise barriers may be preferable or needed. Staff recommend that future MTA plans for construction and operation of this facility be based on the assumption that noise barriers *will* have to be erected around the North Glenridge S&I facility, rather than treat this as a *possible* noise mitigation measure. If subsequent detailed investigations show that this measure is not essential, the noise barriers can be deleted during preliminary design and engineering of the S&I facility. This core planning, design and engineering detail must be satisfactorily resolved before or during preliminary engineering and preparation of the FEIS.

i. Staff concur with the MTA proposal to use vehicle skirts and other on-board noise mitigation equipment and technology to reduce vehicle noise on the Purple Line alignment.

j. MTA indicates that siting the S&I facility at North Glenridge will require extensive grading and fill. This CPDED must be satisfactorily resolved before or during preliminary engineering and preparation of the FEIS for the LPA.

B. Public Facilities

a. The AA/DEIS ignores the impact of the proposed Glenridge maintenance and storage facility on Glenridge Elementary School which abuts the proposed facility on the south. The AA/DEIS states that the "Glenridge maintenance and storage facility would results [sic] in severe noise impacts" from light rail transit (LRT). [4-10] The AA/DEIS goes on to observe that the "noise generated from maintenance and storage activities for LRT [at the Glenridge facility] would result in noise levels reaching the Federal Transit Administration (FTA) severe impact thresholds for nearby residential neighborhoods." [4-56] The AA/DEIS identifies these neighborhoods in several places throughout the plan as being those across Veterans' Parkway, MD 410. However, Glenridge Elementary School abuts the proposed maintenance and storage facility and is much closer than the neighborhoods presumed to be most affected. As noted above, therefore, minimizing or mitigating noise and vibration in the vicinity of the North Glenridge S&I facility is a core planning, design and engineering detail that will require satisfactory solutions before or during preliminary engineering and preparation of the FEIS.

b. The AA/DEIS provides the FTA's definitions of land use categories for transit noise and ground-borne vibration, and clearly identifies schools in Category 3, while residential neighborhoods are in Category 1. It is understood that these two uses should be treated differently. However, the AA/DEIS acknowledges impacts to several schools along the various proposed paths of the Purple Line. It stands to reason that such impacts would be acknowledged and discussed when the facility is not solely an active transitway with vehicles passing by at intervals, but a maintenance and storage facility with the potential for constant vehicle movement and the resulting wheel squeal.

c. MTA should analyze the potential impact of noise and vibration on Glenridge Elementary School and the surrounding neighborhood, and should coordinate with Prince George's County Public Schools on potential abatement or mitigation measures.

d. The Low Investment LRT alternative increases the potential that the exit from the West Lanham Hills Fire and Emergency Medical Services (EMS) Station 28 onto Annapolis Road, MD 450, could be blocked by a stopped light rail vehicle. The AA/DEIS states that this scenario is unlikely because of the provision of a dedicated right-of-way but MTA should coordinate further with the Prince George's County Fire/EMS Department if the selected alternative is Low Investment LRT.

e. All alternatives affect The Maryland-National Capital Park and Planning Commission's Park Police Headquarters at 6700 Riverdale Road. The Park Police Headquarters will be relocated to Walker Mill Park in District Heights in 2009. However, the Special Operations Command (SOC) of the Prince George's County Police Department (PGPD) is also headquartered at this facility and may be impacted by stopped transit vehicles at the adjacent busy interchange at Riverdale Road and the Baltimore-Washington Parkway.

f. The 2008 *Approved Prince George's County Public Safety Facilities Master Plan* recommends relocating the Special Operations Command to a more central location within the county beyond 2021. PGPD may consider relocating the Special Operations Command prior to the opening of the Purple Line.

C. Historic and Archeological Resources

The Historic Preservation Section reviewed the *Purple Line Alternatives Analysis/Draft Environmental Impact Statement* with regard to potential impacts on identified historic resources and archeological sites and concurs with the report's conclusions that there will be no substantive impacts on historic resources or archeological sites within the project area.

D. Community Planning and Local Plan Conformance

a. The AA/DEIS is consistent with the land use recommendations of the 2002 General Plan. All of the BRT and LRT alignments under consideration through College Park will provide opportunities to implement the development envisioned by the General Plan for the Developed Tier, particularly pedestrian- and transit-oriented development in the MD 193 and US 1 Corridors and at the College Park Metro Station.

b. The AA/DEIS is generally in conformance with the land use recommendations of the *1989 Langley Park-College Park-Greenbelt Master Plan.*

c. The AA/DEIS conforms to the land use recommendations of the *2002 College Park/US 1 Corridor Sector Plan* and Sectional Map Amendment.

d. Staff are concerned about the visual and urban design impacts generated on the University of Maryland Campus by the proposed Preinkert Alignment/Design Option. This alignment threatens the visual integrity and historic character of the Morrill Hall Quadrangle, the most historic portion of the campus core. This alignment would also bring the Purple Line very close to meditative gardens located behind the chapel, resulting in negative visual and auditory impact on an area specifically designed for quiet reflection. This option brings the Purple Line along the edge of the Chapel Fields, an area of high visual sensitivity on both the campus itself

and to travelers on US 1, who would have an unobstructed view of the alignment across the fields.

In addition, this alignment raises concerns of pedestrian and bicyclist safety where it passes between LeFrak Hall and the South Campus Dining Hall. This narrow passage is one of the most heavily trafficked portions of the campus, and the short distance between the two buildings leaves little margin of error. Finally, it should be noted that, based off a ¼ mile to a ½ mile radius (approximately 5 to 10 minutes walking time), the Preinkert Drive alignment serves less of the campus than the Campus Drive alignment, both in terms of classroom space and residential dormitories.

e. Staff commend the Maryland Department of Transportation for its commitment to the incorporation of Crime Prevention through Environmental Design (CPTED) principles in the design of the Purple Line transitway and station areas, an issue of particular importance in College Park because of the presence of the University of Maryland and associated student body. Special consideration should be given to the University campus and the College Park Metro Station area as the Purple Line project moves toward final design and approval.

f. Staff recommend that additional attention be paid to sustainability issues in the design of the Purple Line transitway bed and station areas. "Green" tracks and other innovative pervious surface treatments are recommended for use in College Park whenever feasible to reduce the environmental impact of impervious surfaces. Full cut-off, solar-powered lighting fixtures and the use of rapidly renewable building materials for station platform waiting areas are also recommended.

g. There is a technical correction needed on page 4-3. The AA/DEIS does not list the *Approved Master Plan for Langley Park-College Park-Greenbelt and Vicinity* (1989) *and Adopted Sectional Map Amendment for Planning Areas 65, 66, and 67* (1990) in the callout box labeled "Local Plans in the Purple Line Corridor."[1]

D. Transportation—General

a. Staff fully concur with MTA that the Purple Line is an essential part of the future transportation network in Prince George's County and with the Purpose and Need provided by MTA for the Purple Line project:

"The purpose of the proposed project is to provide faster, more direct and more reliable east-west transit service in the Purple Line corridor, which would connect the four major activity centers, including the Metrorail services located there, to each other, and with the communities located between them. The existing and expected future roadway congestion in the corridor will have an increasingly

[1] Also, MTA makes a reference to a "Prince George's County *functional master plan for the Purple Line*" [emphasis added.] No "functional master plan" has been undertaken or is currently planned specifically—or only—for the Purple Line in Prince George's County. The initial 16.4-mile segment—as well as future extensions—of the Purple Line are core county transportation network recommendations in the *Update to the Countywide Master Plan of Transportation* that is now underway. As MTA already noted in the AA/DEIS, the Purple Line is also a core transportation recommendation in several land use master and sector plans that are now underway in the Planning Department, particularly the updated *New Carrollton Transit District Development Plan* and the bi-county *Takoma/Langley Crossroads Sector Plan.*

detrimental effect on the travel times and reliability of east-west bus transit services in the corridor. The proposed Purple Line corridor transit improvements are intended to improve travel times and reliability by providing ore direct services that will operate on dedicated and exclusive lanes and guideways." [Page ES-2]

b. The initial Purple Line segment is both a definitive, core recommendation in the *Update to the Countywide Master Plan of Transportation* (MPOT) and the basis for a number of fixed guideway transit recommendations in the MPOT.

c. Staff also concur that a fixed guideway transit facility, such as the Purple Line, as opposed to increased bus service operating in general vehicular traffic, is the most cost-effective *long-term* public investment that can be made to:
   i. Provide improved, higher quality cross-county and interregional mobility and accessibility options to residents of Prince George's County, particularly county residents who work outside the metropolitan core, including Montgomery County,
   ii. Provide the first fixed guideway transit service to the International Corridor (Crossroads) area, which contains the region's largest concentration of transit-dependent commuters outside of the District of Columbia,
   iii. Fully capitalize on public transportation's role in helping achieve the growth and development envisioned in this county by the 2002 *Approved General Plan*, and
   iv. Take full advantage of the county and the state's multi-billion "sunk investment" in the Metrorail and MARC commuter transit systems.

d. The Purple Line will be of considerably greater long-term consequence to achieving the growth and development goals of the 2002 *Approved General Plan* than any other single public investment that can be made in the transportation network, principally because of the comprehensive foundation it lays for achieving General Plan growth and development goals in both the Developed Tier and in several General Plan Centers and Corridors.

e. This is particularly true of opportunities the Purple Line presents for attracting quality transit-oriented development (TOD) and infill revitalization in the parts of the Developed Tier that are within the service footprint.

f. The Purple Line reinforces the New Carrollton's Metrorail station's position as a major suburban multi-modal transportation center and as a major transit-oriented development site.[2]

g. Further, the Purple Line is, in effect, *the* circumferential transit system envisioned for Prince George's County in the MPOT. The MPOT proposes to eventually connect the Purple Line to northern Virginia via National Harbor and the Woodrow Wilson Bridge, with a possible further connection to the Anacostia Streetcar line. The Purple Line could also connect to a future bus rapid transit line in the Rhode Island Avenue corridor, as proposed by the District of Columbia. None of these interjurisdictional transit options are feasible without the initial segment of the Purple Line to New Carrollton.

[2] In fact, New Carrollton's only peer as a "full service" intermodal transportation center in the metropolitan area is Union Station downtown.

E. Transportation—Mode

a. After carefully reviewing the six alternatives for the Purple Line, staff concludes that the transportation and community benefit objectives of the 2002 *Approved General Plan*, the update to the MPOT and all land use master plans now underway for areas of the county within the Purple Line service area would be optimally achieved by the ***High Investment LRT*** alternative, with the ***Medium Investment LRT*** alternative as an option.

b. Staff also strongly recommend that the full 16.4-mile initial segment of the Purple Line be completed as a single project. MTA should drop consideration of minimal operable segments (MOS) for the Purple Line, *unless* the initial MOS begins at New Carrollton and extends at least as far as Silver Spring.

c. Staff concur with both the Prince George's County Department of Public Works and Transportation (DPW&T) and with staff of the Montgomery County Planning Department that both the BRT and LRT modes appear to achieve a broad range of operational and community benefit objectives. Some of the criteria cited in the cost-effectiveness and user benefits sections of the AA/DEIS indicate that the High Investment BRT alternative *initially* performs slightly better than either Medium Investment or High Investment LRT alternatives. However, BRT has greater limitations on its operational and capital growth capabilities. The long-term system expansion potential of the Purple Line as a transit system and as an anchor for quality transit-oriented development in the Developed Tier communities, in Centers and in Corridors that it will serve could well be stunted if BRT is selected as the LPA. This is of particular concern in Prince George's County, where it will eventually become necessary to add additional vehicles to accommodate greater ridership demand once the Purple Line is extended.

d. Further, while the initial cost-benefit analyses conducted by MTA show rough comparability for both High Investment BRT and Medium and High Investment LRT, the LRT options retain considerably more capacity for growth to accommodate future connections of the extended Purple Line with Metrorail both on the Blue or southern Green Line, and in northern Virginia.

e. The projected ridership on the Purple Line by 2030 is already estimated to be approximately 2,000 riders in the peak load direction. This will severely tax even the High Investment BRT option as proposed by MTA. Prior experience with heavily used BRT systems indicates that accommodating significant ridership increases would probably necessitate trade-offs that compromise BRT's operating efficiency and service quality (especially running time and on-time performance).[3]

f. This additional ridership on future Purple Line extensions in the county makes the ability of any BRT alternative to provide *long-term* quality fixed guideway transit service in Prince George's County extremely problematic.

[3] Ottawa, Ontario; Pittsburgh and Seattle all "outgrew" their BRT systems and encountered significant additional capital costs trying to convert BRT to LRT.

g. Finally, the *Updated* MPOT recommends that transit instead of the single-occupant automobile be the preferred vehicular mode of access and mobility in the future in Prince George's County. A LRT Purple Line provides a more stable, long-term foundation for the considerable additional fixed guideway transit service that is envisioned in the MPOT, and that will be needed to make transit a comprehensive mobility and accessibility alternative to the automobile.

F. Transportation—Alignment

a. Both the Medium and High Investment alternative have essentially the same alignment in this county.

b. Staff concur with MTA and DPW&T that the Purple Line should follow the Campus Drive alignment through the University of Maryland campus. This alignment is consistent with the current University Campus Master Plan and affords the best opportunity for cost-effectively integrating the Purple Line with the East Campus development project and future development on campus and in College Park east of US Route 1.

c. To some extent, the opportunity was missed to integrate the Metrorail Green Line with transit-oriented development opportunities and potential in what is now a General Plan Metropolitan Center at College Park—University of Maryland. Staff views the advent of the Purple Line in the US 1 corridor as an opportunity to "reset" the transportation-land use relationship there and realize more of the growth and development potential in that area.

G. Transportation—Funding

a. Both Maryland and the federal government currently confront considerable uncertainty about funding levels and funding options for major public transportation investments such as the Purple Line. Some of this uncertainty exists irrespective of which operating mode is ultimately selected as the LPA, although the projected costs of either preferred LRT build alternative are higher than those of the High Investment BRT alternative. MDOT has recently had to drastically reduce funding for a considerable number of priority transportation projects. However, there is now the possibility of increased financial support from either reauthorized federal transportation legislation by the 111th Congress, or the state and local infrastructure component of the incoming administration's proposed national economic recovery package. Both of these options should improve the prospects for fully funding the entire initial segment of the Purple Line.

b. It will be critical for MTA to fully "credit" both counties for in-kind contributions to the Purple Line project. In Prince George's County, for example, this particularly pertains to receiving full "credit" for provision of the North Glenridge site for the Purple Line S&I facility. This site is currently owned and operated by The Maryland-National Capital Park and Planning Commission's Prince George's County Department of Parks and Recreation. Some potentially significant costs may be incurred by the Commission's need to relocate Department operations, facilities and equipment from this location to make room for the S&I facility. MTA will need to work very closely with the Commission and with Prince George's County to

accurately and fully account for all county commitments to and investments in the Purple Line project.

H. Transportation—Core Planning, Design and Engineering Details (CPDED)

Given the mode recommendation made above, staff would offer the following comments on CPDEDs that must be resolved before or during preliminary engineering for the LPA and preparation of the FEIS. The list below is neither final nor exhaustive and the current close on-going planning and design cooperation between both counties, the Commission, and MDOT will have to continue, and probably be intensified in Prince George's County, as the Purple Line nears selection of an LPA and preliminary engineering and preparation of the FEIS.

Generally, staff concur with DPW&T that MTA still needs to provide solutions to some outstanding CPDEDs in Prince George's County at a level of detail that is commensurate with what has been provided for the CPDEDs in Montgomery County. These details will in any case need to be fully resolved either before or during preliminary engineering, and before preparation of the FEIS for submission to FTA.

a. One critical CPDED is the operating profile along Paint Branch Parkway in the vicinity of the East Campus development. MTA proposes that the Purple Line share a lane with general vehicular traffic, which is operationally problematic and could adversely affect the long-term growth potential of the Purple Line once it is extended farther into Prince George's County, with a corresponding increase in end-to-end running time.

b. Staff concur with MTA's position that the North Glenridge S&I facility needs to be "fleshed out" in greater design, engineering and operational detail. Experience with light rail S&I facilities indicate that they present a number of stand-alone engineering and design challenges that are independent of the challenges of operating the transit system itself. As noted above, there are both significant grading and long-term noise and vibration impacts that must be identified and minimized around the North Glenridge site before or during preliminary engineering of the locally preferred alternative.

c. The Purple Line's operating profile at the intersection of MD 201 (Kenilworth Avenue) and MD 410 (East-West Highway) may be a CPDED, depending on which alternative is finally selected for the Purple Line. Staff discussions with MTA about this particular item are on-going. Both at-grade and elevated options are still being actively considered at this intersection, which is also the focus of a significant redevelopment and revitalization planning effort. Further, the operating profile that is selected for this intersection will almost certainly affect the Purple Line alignment across the Baltimore-Washington Parkway and could require property takings along MD 410.

d. Staff are concerned about the details of integrating the Purple Line alignment and operating profile (at-grade or elevated, in shared or dedicated lanes) with the Takoma-Langley Transit Center at MD 193 (University Boulevard) and MD 650 (New Hampshire Avenue). This is an important CPDED. This facility will be shared between the two counties but it arguably plays a somewhat greater role in long-term redevelopment and revitalization of the International Corridor within this county. In

any case, it will be the principal non-Metrorail intermodal transfer facility for the Purple Line in this county. It will therefore be important for MTA to ensure the same operationally efficient and cost-effective integration of the Purple Line with this transit center as is being planned for integrating the Purple Line with the Sarbanes Transit Center. More systematic coordination with the State Highway Administration will be also needed.

e. The alignment and operating mode of the Purple Line LPA should not preclude a future Purple Line station at or near the University of Maryland University College and Conference Center at Adelphi Road. Such a station was envisioned in the *Bi-County Transitway [*now Purple Line*]—International Corridor Planning Study* and should remain a long-term growth option for the Purple Line and to support and anchor the revitalization in the eastern part of the International Corridor. In general, staff strongly recommend a major siting and design review for all Purple Line stations in the county by MTA in coordination with this department, DPW&T, and MTA.

f. The final alignment at New Carrollton must ensure cost effective and operationally feasible extensions of the Purple Line farther into Prince George's County. Past experience with Metrorail and other fixed guideway transit systems repeatedly indicates that poor or short-sighted design and siting of "interim" transit terminal facilities have often produced insurmountable cost and construction constraints that prevented otherwise desirable extensions of those systems. Given how central the Purple Line extensions are to both the transportation systems and long-term growth and development plans of this county, it is imperative that the alignment and terminal siting of the Purple Line at New Carrollton be properly planned and undertaken, and be coordinated with implementation of the land use recommendations of the updated *New Carrollton Transit District Development Plan.*

Staff Reviewers
Purple Line Alternatives Analysis and Draft Environmental Impact Statement

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- RECORD #3015 DETAIL

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Preserving America's Heritage

December 31, 2008

Ms. Diane Ratcliff
Director
Office of Planning
Maryland Transit Administration
6 Saint Paul St.
Baltimore, MD 21202-1614

RE: *Draft Environmental Impact Statement for Purple Line*
Montgomery and Prince George's Counties, Maryland

Dear Ms. Ratcliff:

On October 10, 2008, the Advisory Council on Historic Preservation (ACHP) received a copy of the Draft Environmental Impact Statement for the referenced undertaking. Our comments pursuant to the National Environmental Policy Act of 1969 (NEPA) were requested. We have no comments pursuant to NEPA at this time.

While the documentation provided indicates that the proposed undertaking may adversely affect historic properties, we have no record of receiving notification of adverse effects from the Federal Transit Administration (FTA) regarding this undertaking as is required under our regulations, "Protection of Historic Properties" (36 CFR Part 800). Please continue to consult with the Maryland State Historic Preservation Office (SHPO) and other consulting parties to complete the requirements of the Section 106 process. In the event FTA determines, in consultation with the Maryland SHPO, that the proposed undertaking may adversely affect properties listed or eligible for listing in the National Register of Historic Places, please provide the required notification and documentation to ACHP in accordance with 36 CFR § 800.6(a)(1) and § 800.11(e).

If you have any questions or would like to discuss this issue, please contact Blythe Semmer by telephone at (202) 606-8552 or by e-mail at bsemmer@achp.gov.

Sincerely,

for Charlene Dwin Vaughn, AICP
Assistant Director
Office of Federal Agency Programs
Federal Permitting, Licensing, and Assistance Section

ADVISORY COUNCIL ON HISTORIC PRESERVATION
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- RECORD #2850 DETAIL

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Attachments :	NNMC Purple Line AA DEIS Review Comments.PDF (540 kb)

DEPARTMENT OF THE NAVY
NATIONAL NAVAL MEDICAL CENTER
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IN REPLY REFER TO

5000
Ser 09FM/ 0098
JAN 14 2009

Michael Madden
Maryland Transit Administration
6 Saint Paul Street
Baltimore, MD 21202

Dear Mr. Madden:

Subj: NATIONAL NAVAL MEDICAL CENTER PURPLE LINE ALTERNATIVES ANALYSIS/DRAFT ENVIRONMENTAL IMPACT ATATEMENT (AA/DEIS)

Enclosure (1) contains comments from the National Naval Medical Center regarding the Purple Line Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS).

We are encouraged by the detail and thorough analysis in which the Maryland Transit Administration outlined the various alternatives proposed for the Purple Line. In addition, we commend you for your significant cooperation with local communities and organizations as they provide suggestions and guidance to further the development of those alternatives. We are certain that whichever alternative is ultimately chosen will encourage and provide efficient mass transit use, provide a sustainable transit solution for future growth, contribute to the attainment of regional air quality goals and take into consideration existing and future employment concentrations.

Sincerely,

D. J. ZINDER
Deputy

Enclosure: (1) NNMC Comments on Purple Line AA/DEIS

1/5/09

Purple Line *Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS)*
Reviewed by: National Naval Medical Center (NNMC)

NNMC Comments

1. Pg. ES-2 - Statement about the Low Investment BRT, "This is the only alternative that would operate on Jones Bridge Road, directly serving the National Institutes of Health and the National Naval Medical Center at Rockville Pike and Jones Bridge Road." The statement does not take into consideration variation #1 of the Medium Investment BRT which also operates along Jones Bridge Road.
2. Pg. ES-7 - Statement, "With the introduction of any one of the BRT or LRT alternatives, as well as the TSM Alternative, there would be opportunities to adjust the existing and future bus network in the corridor in response to service redundancies, thereby reducing operating costs to the transit providers. These reductions would be similar across all alternatives." Would it not be in the MTA's best interest to review/coordinate with local providers to identify these redundancies now in an effort to further justify the initial and continued expense of the each of the improvement options presented?
3. Pg. 1-1 - The "Need" is not clearly identified. The purpose is spelled out clearly, components of the need and evaluation criteria are mentioned but not clearly articulated or separated. Chapter 6 identifies a statement that could be the "need" that is also in the first chapter. The need should be clearly identified to allow the decision maker to evaluate how well the need is met.
4. Pg. 1-2 (and pg. 6-10) - Evaluation criteria do not include the time to construct (time lines for each alternative), the reliability of the systems, the likelihood of disruption, and flexibility in routing which all would seem to be important criteria for consideration of choices. For example the high build LRT would seem to be less likely to be interrupted and thus highly reliable but would have no/very few options if it is interrupted. The low build BRT would be more flexible if road construction or accidents required detours but would probably experience many more such interruptions. Quantification of this, if

possible, would show additional value for some options.

5. Pg. 1-9, Table 1-2. Current rider-ship information is broken into districts which can encompass multiple proposed Purple Line stops. Would it not be more beneficial to break down the expected rider-ship by proposed Purple Line stop location (thus, by Purple Line alternative)? This type of detail would allow reviewers of the document to have a better understanding of the proposed options.
6. Pg. 1-10, Table 1-3. The table identifies Existing Employment at Major Centers. Specifically it outlines Bethesda CBD which accounts for 34,833 jobs. However, the chart fails to mention the center containing the National Naval Medical Center (NNMC), National Institutes of Health (NIH) and Suburban Hospital. NNMC has roughly 8000 employees today and will have 10,500 employees by 2011. In addition, NIH conservatively lists 18,000 employees on their web site while Suburban Hospital states 3180. Both NIH and Suburban Hospital are planning on future growth and development. Therefore, this puts the low end estimate today at 29,180 employees with substantial growth to this figure by 2011. These figures do not take into account the significant number of visitors that travel to these sites on a daily basis. As there are alternatives being presented which route through this employment center it would seem important to highlight current populations as reference for review.
7. Pg. 2-7 - Statement, "The National Naval Medical Center anticipates an increase of approximately 2,200 to 2,500 employees of which an estimated 60 new riders would use the Purple Line." Per NNMC's November 2008 Master Plan submission to NCPC (for February 2009 review), staff parking on the NNMC campus will be very constrained in the future. Based on staff parking availability, alternative commuting methods such as mass transit will be required. How was this figure (60) derived as it appears to be very low for new rider-ship?
8. Pg. 3-15 & 3-16 (LOS Tables) - Important to highlight that the current and future LOS in the AM and PM at the intersections of Jones Bridge Road/Rockville Pike and Jones Bridge Road/Connecticut are either failing or will be in the not too distant future. Jones Bridge Road is highly congested in the AM and PM and

could benefit by not having additional transit traffic along this artery.

9. Pg. 3-18 - "For the Purple Line, there is one major medical facility located adjacent to the proposed alternatives. The National Naval Medical Center is located along Jones Bridge Road, adjacent to the Low Investment BRT. However, the National Naval Medical Center is a United States Naval facility, intended for treatment of servicemen and women; this facility is not an emergency treatment center for area residents. Access to this facility would not be affected by the presence of BRT vehicles along Jones Bridge Road." Does this statement contradict the LOS studies outlined on Pg. 3-15 & 3-16?
10. Pg. 4-6 - Statement, "None of the alternatives would require residential property acquisition or displacements, or affect community cohesion in Bethesda. The Low Investment BRT would result in strip acquisitions from property owned by the National Institutes of Health and the National Naval Medical Center." Where would the strip acquisition be required along the National Naval Medical Center (i.e., confirm it is along Jones Bridge Road at the intersection with 355 for a turn lane)?
11. Pg. 6-10 - Evaluation criteria should mention that a transit system seen as "permanent" will attract people to communities along the transportation corridor especially near the major stops. This is seen with all subway, train, and roadways where property values increase due to proximity to permanent transportation options. Bus routes fail to attract people as measured by property values
12. Grammatical
    a. Pg. E-3; Missed placing the word "are"; Sentence should read: "There are no impacts to public parking anticipated as a result of the No Build and TSM alternatives…"
    b. Pg. 1-13, Table 1-8; 2nd bullet section "Improve Transit Operations Efficiencies"; The first bullet point, starting with "Improve overall dependability and reliability…", appears to have two separate bullet points combined on this one bullet point
    c. Pg. 1-15; Need to add an "s" at the end of require; Should read: "The CAA requires the Washington metropolitan area to adopt a structured…"

d. Pg. 3-3, Table 3-5; Table heading should read "2030" vs. "20303"
e. Pg. 4-22, misspelled "trailer" within the parenthesis; Should read: "In addition to the future Capital Crescent Trail (currently the Interim Georgetown Branch Trail)…"

NNMC is understands the challenges associated with the Purple Line corridor. As the DEIS states there is "slow and unreliable transit travel times", "limited travel mode options for east-west travel", "degraded mobility and accessibility between major activity centers and residential areas" and "degraded transit accessibility to the larger metropolitan region due to inferior connections to radial Metrorail lines and to other rail and bus services." It will be necessary in the future to pursue transit projects (such as the options presented in the Purple Line DEIS) to mitigate the increased congestion associated with the population growth within the national capital region. NNMC commends the MTA for their extensive community coordination and involvement for the development of the Purple Project and working towards a long term sustainable solution.

- RECORD #2112 DETAIL

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NCPC
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IN REPLY REFER TO:
NCPC File No. 6884

January 16, 2009

Ms. Diane Ratcliff
Director
Office of Planning
Maryland Transit Administration
6 St. Paul Street, 9th Floor
Baltimore, MD 21202

RE: Alternatives Analysis/Draft Environmental Impact Statement and Section 4(f) Evaluation of the Purple Line

Dear Ms. Ratcliff:

Thank you for the opportunity to comment on the Alternative Analysis (AA), Draft Environmental Impact Statement (DEIS) and Section 4(f) Evaluation of the Purple Line. The AA/DEIS comments provided below focus on the National Capital Planning Commission's (NCPC or "the Commission") role as the central planning agency for the federal government in the National Capital Region (NCR). The Commission coordinates all federal planning activities in the region, and has several planning functions: comprehensive planning; project planning; federal project and master plan reviews; and multi-year federal capital improvements planning. Among its major responsibilities are preparing long-range plans and special studies to ensure the effective functioning of the federal government in the NCR; preparing jointly with the District of Columbia government the *Comprehensive Plan for the National Capital*; approving federal master plans and construction proposals in the District of Columbia, as well as reviewing master plans and area plans proposed by state, regional and local agencies for their effect on the federal establishment. We invite you to visit our website, www.ncpc.gov, for additional information.

The Purple Line Build Alternatives are adjacent to or will cross federal land, affect federal facilities and operations, and have other broad impacts on federal interests in the NCR; thus our primary interest is to ensure that the environmental documentation for the Purple Line adequately and appropriately identifies and addresses these topics.

NCPC supports the overall goals of the Purple Line and finds them to be generally consistent with a number of policies of the *Comprehensive Plan for the National Capital: Federal Elements* (Comprehensive Plan)**,** which is available on NCPC's website. NCPC finds that the Purple Line project goals are generally consistent with the *Smart Growth and Sustainable Development Planning Principles* of the Comprehensive Plan. Based on the DEIS alternatives analysis, all the Build Alternatives will improve mobility along the Purple Line corridor. If designed properly, the Purple Line can also mitigate poor air quality, alleviate traffic congestion, and increase access to parkland in the region. Similarly, if land use and transportation development is appropriately planned and linked, it will also support transit-oriented development within the activity centers and link affordable communities to job centers.

Consistent with NEPA requirements, the Purple Line DEIS needs to evaluate how the Build Alternatives support the principles and policies of the *Comprehensive Plan for the National Capital: Federal Elements*, which identify many federal interests. While the DEIS considers compatibility of the Purple Line with the local land use plans of Montgomery County and Prince George's County, it does not consider consistency of the alternatives with the *Comprehensive Plan of the National Capital: Federal Elements*. That analysis should be completed prior to selection of the Preferred Alternative. Consistency with the Comprehensive Plan is also an important consideration in NCPC's review of proposed changes to the General Development Plans for the stream valley parks, discussed below.

NCPC review may be required for this project and should be identified in the analysis.

- The Capper-Cramton Act of May 29, 1930 (46 Stat. 482), authorizes NCPC to formally review any proposed changes to the stream valley parks (see attached Map of Capper-Cramton parks along the Purple Line route) for compliance with its approved plans. The FHA Section 4(f) *de minimis* provisions do not supersede other federal laws over parkland such as the Capper-Cramton Act.
- Any proposed changes to the existing WMATA Metrorail stations will require NCPC review as authorized by the Washington Metropolitan Area Transit Regulation Compact on December 22, 1960, as amended March 29, 1963 [Public Law 774, 80 Stat. 1324, Article IV 14 (c) (3)].
- Several alternatives appear to require use of property on federally-owned facilities with existing NCPC-approved master plans and as such, may require NCPC review.

In addition to NCPC review, because the Build Alternatives will impact federal lands, MTA must coordinate with, submit for review, and/or seek approval from the appropriate federal agencies, including:

- the National Park Service (NPS), for any work involved in the Purple Line crossing the Baltimore-Washington Parkway;
- the U.S. Army Corps of Engineers to acquire Section 404 permit/s for wetlands;

- the National Institutes of Health (NIH), regarding any use of its property for a Purple Line transit way; and
- the National Naval Military Medical Center (NMMC) regarding any use of its property for a Purple Line transit way.

NCPC urges MTA to coordinate with affected federal agencies. Several of the alternatives may require the support of federal agencies to proceed as proposed. The views of those agencies would be a useful part of the EIS.

To assist you in analyzing the Purple Line alternatives for compatibility with the Comprehensive Plan, we are providing a description of the types of information about Comprehensive Plan consistency that should be included in the EIS, organized around topic areas similar to several of the Federal Elements of the Comprehensive Plan.

Federal Workplaces
As several large federal campuses are immediately adjacent to Build Alternative alignments, the impacts to federal facilities and operations should be clearly identified in the EIS prior to selecting a preferred alternative. Many of these facilities have long-term development or master plans (including transportation plans) that could affect, or be affected by, the Purple Line alternatives. In addition to NPS park properties, NIH and NMMC, the Purple Line will also provide service to the Internal Revenue Service (IRS) Headquarters at the New Carrollton Metrorail station, the National Oceanic and Atmospheric Administration (NOAA) at the Silver Spring Metrorail station and a new station in proximity to the Fort Detrick United States Army Garrison-Forest Glenn Section, which is managed by Fort Detrick.

The Comprehensive Plan notes that appropriate planning and the provision of goods and services can enhance the productivity and operations of federal workplaces. The DEIS should identify the degree to which the various alternatives address the Federal Workplace policies, including proposed actions that can expand the choices of federal employees working in the corridor to a variety of housing, access to goods and services, and non-single-occupancy vehicle travel modes, as well as expand transportation choices for visitors and customers of these facilities. The DEIS should also identify impacts unique to certain alternatives, such as the Build Alternatives that appear to be located on portions of the NMMC and NIH.

Transportation
The Comprehensive Plan "Investment Priorities" section in the Transportation Element specifically identifies transit improvements that increase capacity and serve highly-developed areas in the National Capital Region as priorities for federal funding. The DEIS has clearly identified how the Purple Line will increase transit use and serve the transit-oriented activity centers along the corridor.

Of the six Build Alternatives, two provide direct service to NIH and the NMMC (and all alternatives improve transit connections to these two sites) while all Build Alternatives provide direct service to the Internal Revenue Service Headquarters, through a stop at the New Carrollton Metrorail station, and the National Oceanic and Atmospheric Administration, through a stop at the Silver Spring Metrorail station. The proximity of the Purple Line to the Fort Detrick United States Army Garrison-Forest Glenn Section may enhance transit use and provide a transit alternative for trips between that facility and NMMC.

The Comprehensive Plan and other federal policies support the location of federal facilities near transit, require federal agencies to develop plans that encourage employee use of transit, and encourage federal employees to use transit or other non-single occupant vehicle trip modes. Federal workers and visitors to federal facilities comprise a key percent of current MetroRail users, and are likely to be significant users of the Purple Line transportation improvements. The various Build Alternatives will likely affect the transportation management plans of the federal agencies along the corridor. These include specific strategies to encourage change in employee travel modes, trip timing, frequency and length, and travel routes so as to reduce traffic congestion and improve air quality. The Build Alternatives that result in a deterioration of travel time on intersections for arterials that serve as main access to federal employment centers could have a negative impact on federal employees' commute times.

The Comprehensive Plan also identifies federal support for multi-modal commuting strategies. Included in some of the Build Alternatives is the development of the Capital Crescent Trail which will provide an ADA-accessible hiker-biker trail connecting to the existing regional trail systems. Walking or biking on the trail may become an alternative travel mode to work for federal employees.

Again, we encourage MTA to coordinate with these federal agencies and to include in the EIS an assessment of how the various alignments and transportation modes compare in providing transportation choices, mobility and convenience to current and future federal workers and federal facility users, and how federal workers and visitors would contribute to Purple Line ridership.

In addition, the routes and transit type of the Build Alternatives at the western end of the Purple Line have varying impacts to the NIH and NMMC. To provide complete information prior to selecting a preferred alternative, the environmental documentation should provide the same level of detailed analyses for all of the alternative variations at the western end of the Purple Line. Lastly, the Build Alternatives maps should label all the streets that are mentioned in the Alternatives discussion. For example, it is unclear how the various alternative routes for the western end of the line will impact the Bethesda CBD because street names are missing on the maps.

Parks and Open Space
The DEIS alternatives will impact various parks and open spaces that are under the planning jurisdiction of NCPC, including several stream valley parks: Rock Creek, the Northwest Branch, Paint Branch and Sligo Creek. *De minimis* impact findings satisfy Section 4(f) only. These federally-transferred properties are subject to the Capper-Cramton Act, which requires NCPC's additional review of revisions to the General Development Plans for the respective stream valley parks and compliance with the Comprehensive Plan.

The Comprehensive Plan calls for the federal government to ensure that Rock Creek Park and its tributary parks continue to serve as important natural resource recreational and cultural areas. The Comprehensive Plan policies also encourage the integration of a regional network of parks, open space, greenways and trails that could improve and increase recreational and commuter opportunities; and link the stream valley parks. The Comprehensive Plan includes four policies for preserving the scenic quality and historic value of parkways that should be addressed in the DEIS. The Baltimore-Washington Parkway, which the National Park Service (NPS) owns, is one of the major parkways in the National Capital Region that has been threatened in the past by visual and physical encroachment. The following information should be provided to clarify the impacts of the Purple Line to park resources.

a. In the description of the BRT alternatives in Chapter 2, clarify how the Purple Line will cross the Baltimore-Washington Parkway.
b. In Section 4.4.3 of the DEIS, include NCPC and NPS among the agencies with jurisdiction over the public parklands. It should also include the NCPC review of the Capper-Cramton stream valley parks in the review process for the Purple Line.
c. Provide a map that shows the location and general width of vegetative buffers proposed along the Purple Line for each of the Build Alternatives.

Federal Environment and Preservation and Historic Features
The DEIS should provide detailed information (see list below) that could inform NCPC and other federal agencies better as to which alternative is most compatible with and supports the federal interests reflected in the Environment Element, and the Preservation and Historic Features Element, of the Comprehensive Plan. The DEIS "Summary of Key Evaluation Measures for Alternatives" notes that the impacts to environmental resources are identical for the No Build, TSM and Build Alternatives. This could not be possible since the No Build and TSM alternatives do not propose transit ways through the stream valley parks or federal lands, nor will these alternatives require any excavation for construction of aerial structures and tunnels, land acquisitions, property displacements and clearing of mature trees, as the Build Alternatives would require in varying degrees. In addition, the Low Investment BRT alternative will involve strip acquisition of NIH property. An archeological site, "Taylor," on the southeast portion of the NIH property could be impacted also. Although identified in Chapter 4 of the DEIS

(Environmental Resources, Impacts and Mitigation), these impacts to the NIH site should be identified in the "Enhance Environmental Quality" section of the "Summary."

To assess consistency with Comprehensive Plan policies (which will also be needed for Capper-Cramton review) the following information and analyses should be provided:

a. For each alternative, provide details on the impact of transit ways, bridge expansions (i.e., Sligo Creek and Baltimore-Washington Parkway), catenary wires, power substations, retaining walls, fences and other required appurtenances for the BRT and LRT on the stream valley parks. These impacts include visual impacts, tree canopy removal, ground disturbance, wildlife, and water quality impacts (water temperatures, erosion and downstream sedimentation). If there are differences in severity and scale of impacts for the BRT and LRT alternatives, these should be clearly described in the environmental analysis.
b. Provide a detail map of the proposed Capital Crescent trail alignment between Bethesda and Silver Spring that shows clearly how the transit way and hiker-biker trail will traverse Rock Creek Park. Photo simulations of the Purple Line through the natural areas in the stream valley parks should also be provided.
c. The DEIS concludes that the Purple Line will have minimal impacts to wildlife corridors through the stream valley parks because the alignment follows existing trails. However, the difference between the impact of a hiker-biker trail and a transit way with high speed vehicles traveling in both directions through the wildlife corridors could be significant and should be addressed. Further, as the Purple Line alignments cross several stream valley parks, an assessment of the overall impacts to water resources and wildlife habitat in the stream valley parks should be provided.

We also encourage you to diligently consult with the Maryland State Historic Preservation Office (SHPO) to address the mitigation measures for impacts to historic properties such as the Falkland Apartments and the Columbia Country Club.

We appreciate your consideration of our comments at this stage of environmental review. We look forward to future coordination with the MTA, and would be pleased to provide any further information. Please contact Amy Tarce at (202)482-7241 or amy.tarce@ncpc.gov for further information.

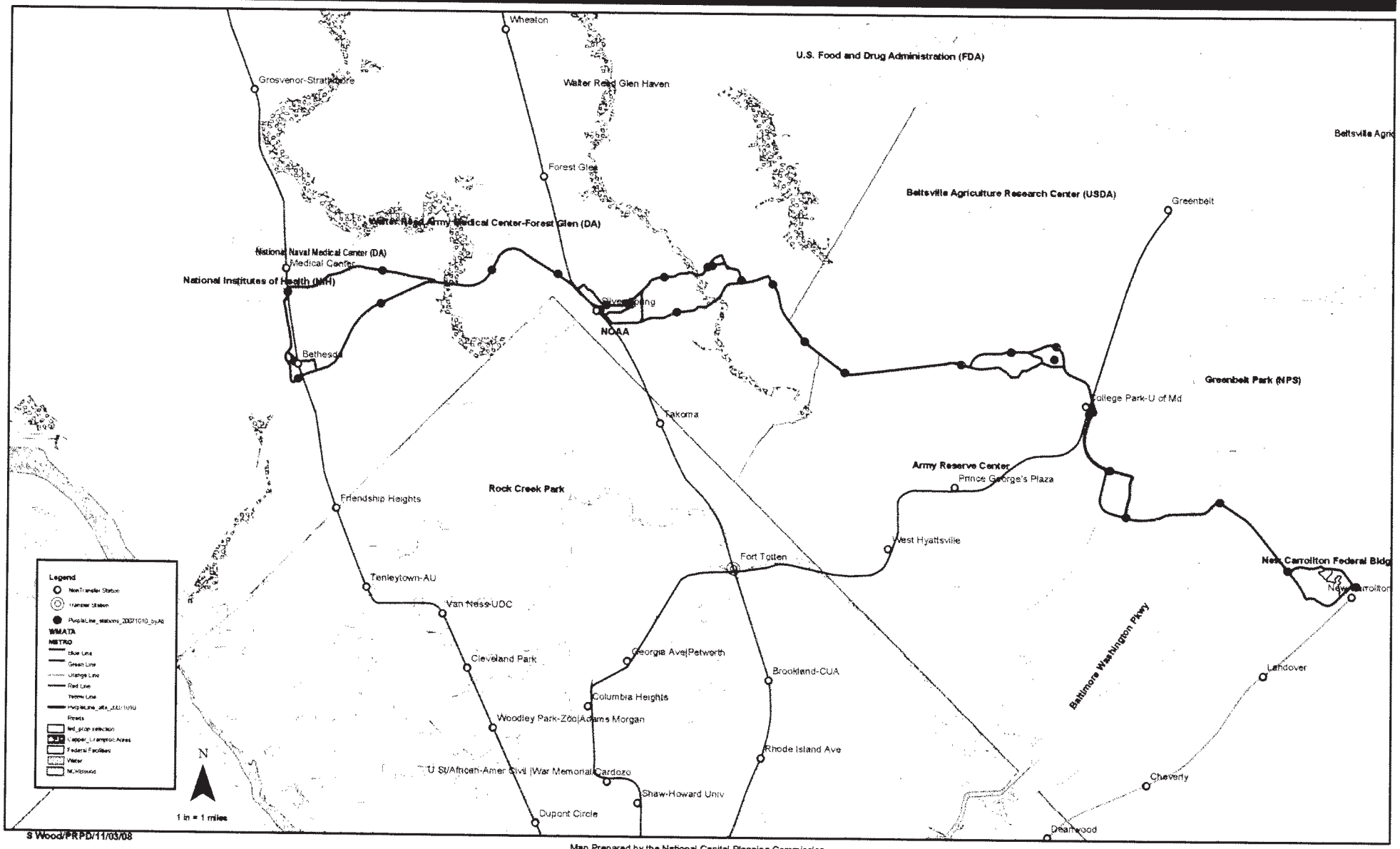
Sincerely,

Julia Koster

Julia Koster, AICP
Director, Planning Research and Policy Division

Attachment

Purple Line Rail Aligment Alternatives and Stops

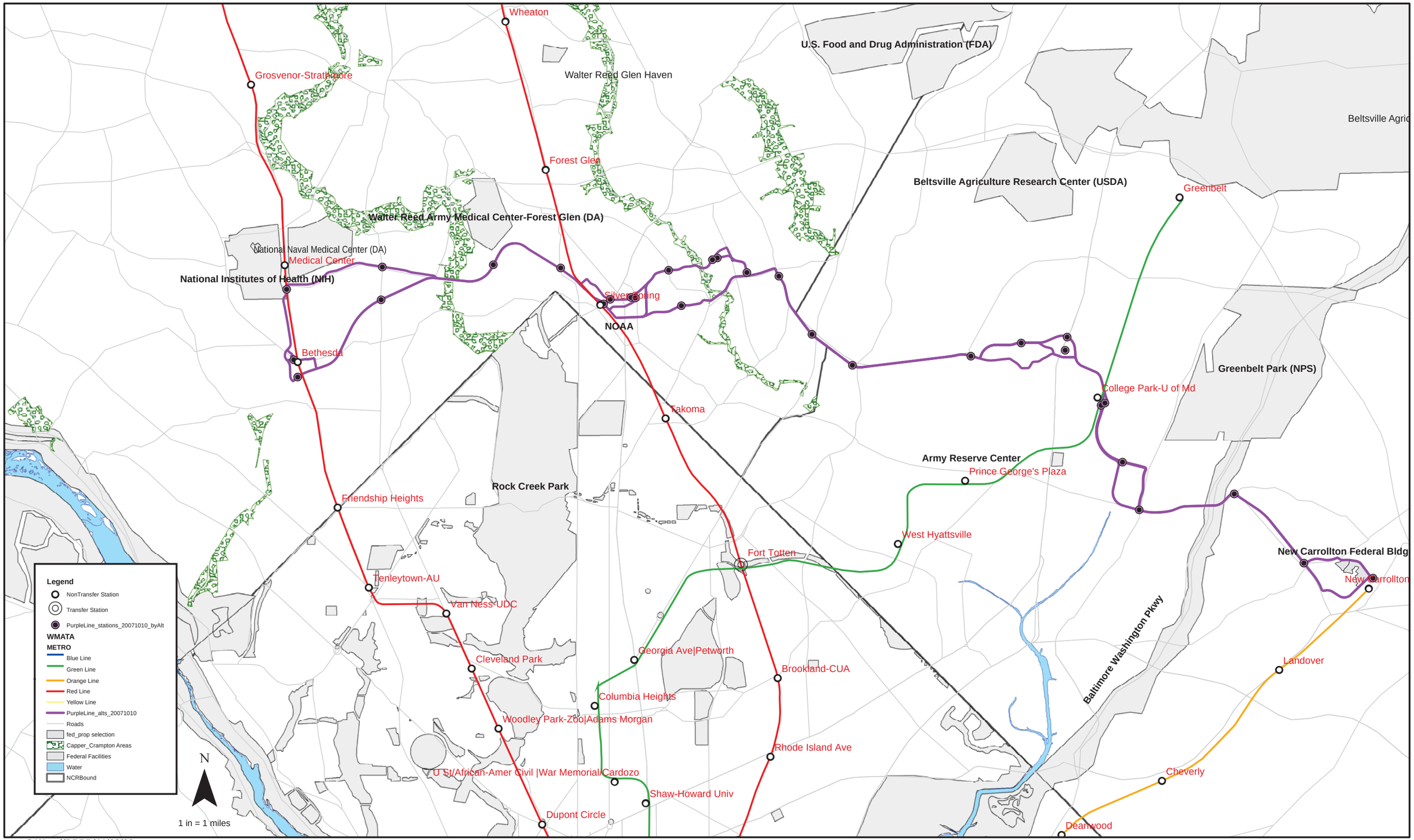


S Wood/PRPD/11/03/08

Map Prepared by the National Capital Planning Commission

NCPC File Number 6884
January 13, 2009

Purple Line Rail Aligment Alternatives and Stops



S Wood/PRPD/11/03/08

Map Prepared by the National Capital Planning Commission

NCPC File Number 6884
January 13, 2009

- RECORD #2108 DETAIL

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Attachments :	NIH.pdf (75 kb)

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

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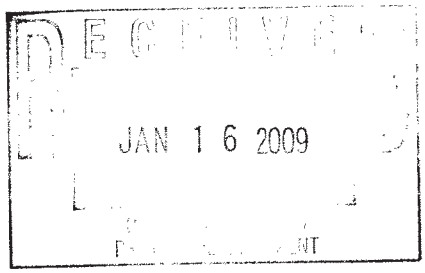

January 14, 2009

Ms. Diane Ratcliff
Director
Office of Planning
Maryland Transit Administration
6 St. Paul Street, 9th Floor
Baltimore, MD 21202

Reference: Comments on Draft Environmental Impact Statement for the Purple Line Alternatives Analysis

Dear Ms. Ratcliff:

The National Institutes of Health (NIH) has reviewed the October 17, 2008 Draft Environmental Impact Statement (EIS) for the Purple Line Alternatives Analysis and the potential impact of the transit line on NIH interests, in particular activities on the Bethesda campus. As described in the Draft EIS, the proposed Low Investment and Medium Investment Extended Bus Rapid Transit (BRT) options would locate new Purple Line facilities on NIH land near the intersection of Woodmont and Wisconsin Avenues. NIH has three principal concerns with these options.

The first concern is that NIH has granted the Montgomery County Department of Public Works and Transportation (MCDPWT) permission to construct a regional stormwater management facility in the southeast quadrant of our campus just west of Woodmont Avenue. The Stoney Creek Pond, which also is in our approved campus Master Plan, is designed to serve portions of the Bethesda campus as well as downtown Bethesda by managing urban runoff before it enters Rock Creek. As shown in the Draft EIS, the proposed Purple Line transit lanes in the Low Investment BRT would encroach into the area designated for the pond and compromise its ability to accomplish its purpose. Given the strategic location of the pond and its importance to regional stormwater management and the Rock Creek Watershed, NIH cannot support any option that could jeopardize its success. We also recommend that you note the presence of Stoney Creek Pond on the NIH campus in your Final EIS.

The second concern is that the southeast corner of the campus is part of our perimeter buffer which has been carefully negotiated with the surrounding residential neighborhoods. It is used to screen activities on the campus and reduce noise, lighting, and other impacts on the adjacent community. NIH takes great care in protecting the buffer in as natural a state as possible. It is a valuable resource which enhances the character of the campus and contributes to the public's perception of the Bethesda campus as a special place.

The third NIH concern is that the general area of the proposed BRT facilities is considered archaeologically sensitive as described in both the NIH Master Plan and the Draft EIS; consequently, NIH has historically restricted new development in this zone to preserve any artifacts that may be present there. While we recognize that more detailed archaeological surveys would be needed to confirm the presence of historic resources should either the Low Investment or Medium Investment Extended BRT be selected, our preference would be to leave this area in an undisturbed natural state.

In summary, while NIH recognizes the value of an inter-county transit facility for the region and those NIH employees who now commute daily on congested roadways across Montgomery and Prince George's Counties, as well as staff at the future Walter Reed National Military Medical Center, the Low Investment and Medium Investment Extended Bus Rapid Transit (BRT) options would have negative impacts on NIH and MCDPWT efforts to manage stormwater, the established campus perimeter buffer and, potentially, the archeologically sensitive areas associated with the site.

Please feel free to contact me if you have any questions regarding the NIH position. I can be reached at (301) 594-0999.

Sincerely,

D. G. Wheeland, P.E.
Director, Office of Research Facilities

cc:
Colleen Barros
Alfred Johnson
Tom Hayden
Ron Wilson
Susan Hinton
Kenny Floyd

- RECORD #3385 DETAIL

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Attachments :	DOI comments on DEIS.pdf (64 kb)

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, DC 20240

TAKE PRIDE IN AMERICA

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PEP/NRM

ER 08/1081

Ms. Diane Ratliff
Director
Office of Planning
Maryland Transit Administration
6 St. Paul Street, 9th Floor
Baltimore, Maryland 21202

Dear Ms. Ratliff:

As requested, the Department of the Interior (Department) reviewed the draft Environmental Impact Statement (EIS) and Section 4(f) Evaluation for the **Purple Line, from Bethesda, Montgomery County to New Carrollton, Prince George's County, Maryland.** The Department offers the following comments and recommendations for your consideration.

Section 4(f) Comments

The Department concurs with the Federal Transit Administration (FTA) that properties in the project study area eligible for consideration under Section 4(f) of the Department of Transportation Act of 1966 (48 U.S.C. 1653(f)) will be affected by the project. According to the Section 4(f) Evaluation, one historic property will be affected by the project. It is also stated that a Memorandum of Agreement will be developed between Section 106 consulting parties as specified in 36 CFR 800. In addition, it appears that impacts to a single park property have not yet been determined; specifically, for the four build alternatives that require dedicated lanes under the Baltimore-Washington Parkway. Therefore, the Department cannot concur that all measures to minimize harm have been employed. We will defer until more information becomes available on design and consultation.

General Comments

It seems that many details of the proposed Purple Line between Bethesda and New Carrollton, Maryland, remain unresolved. In the current proposal there are four build alternatives that require new designated transportation lanes passing under the Baltimore-Washington Parkway, (Parkway) a unit of the National Park Service.

However, the Parkway, which is listed on the National Register of Historic Places (NRHP) is not identified as a "public parkland and recreation area." As a result, the Department cannot concur that all measures to minimize impacts to the Parkway have been identified or employed.

Specific Comments

Section 4.10.1 Groundwater and Hydrology, 3rd column, 1st paragraph

Interception of rock fractures could cause minor changes to ground water flow, as described in the text. However, of equal if not more concern is the possibility of these interceptions causing ground-water seepage into tunnels. Earl Greene and others (USGS Water-Resources Investigation Report 03-4294, 2003) did a study prompted by the frequent water-related shut-downs of the Red Line in Bethesda. Their report, available at http://pubs.usgs.gov/wri/wri034294/, identified permeable (water bearing) joints and fractures as a source of water into the tunnels. A dewatering well with a sump pump was used to mitigate the situation.

Section 4.2 Communities, subsections 6, 9, 10, 14, 15, and 16

When identifying residential property displacements, the document should state consistently when there are no displacements proposed.

Section 4.5.4 Survey Results for Archeological Resources, 1st paragraph

Additional information should be collected to determine whether the five remaining archeological sites are eligible for listing on the National Register of Historic Places.

Section 4.5.4, Survey Results for Archeological Resources, 5th & 6th paragraphs

In both paragraphs, in their last sentences, assumptions are made. Identify who made these and what they were based on – previous fieldwork, professional judgment, or some other criteria?

Figure 4.4.1 Potential Direct Use of Public Parklands and Recreational Areas

The Baltimore – Washington Parkway should be added as a public park and recreation area. Also add the Parkway to Table 4.4-1 along with the potential impact in miles and percentage of the Parkway.

Table 4.5-1 Properties more than Fifty Years Old

We could not find any narrative that describes the Old Bethesda Commercial District (map ID 195), which is identified as a potentially eligible property with adverse impacts

designated by the "red lettering." If this property does not have adverse impacts, the red lettering should be removed.

Table 6.2 Summary of Key Evaluation Measures for Alternatives, direct impacts to parklands, first bullet

Change 11 to 12 to include the Baltimore–Washington Parkway.

The Department has a continuing interest in working with the FTA to ensure impacts to resources of concern to the Department are adequately addressed. For continued consultation and coordination with issues concerning Section 4(f) resources and the Environmental Impact Statement, please contact David Hayes, Regional Transportation Liaison, National Capital Regional Office, National Park Service, 1100 Ohio Drive, SW, Washington, DC 20242; telephone 202-619-7277.

We appreciate the opportunity to provide these comments.

Sincerely,

Willie R. Taylor
Director, Office of Environmental
Policy and Compliance

- RECORD #3016 DETAIL

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Submission Content/Notes :	
Attachments :	EPA.pdf (174 kb)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

January 14, 2009

Ms. Diane Ratcliff
Director, Office of Planning
Maryland Transit Administration
6 Saint Paul Street, 9th Floor
Baltimore Maryland 21202

Re: Purple Line, Alternatives Analysis/Draft Environmental Impact Statement, Montgomery and Prince George's Counties, Maryland, September 2008 (CEQ No. 20080422)

Dear Ms. Ratcliff,

In accordance with the National Environmental Policy Act (NEPA) of 1969, Section 309 of the Clean Air Act and the Council on Environmental Quality regulations implementing NEPA (40 CFR 1500-1508), the U.S. Environmental Protection Agency (EPA) has reviewed the Alternatives Analysis/ Draft Environmental Impact Statement (AA/DEIS)for the Purple Line, referenced above. The document is complete and written in a manner easily readable by the public and agencies. The document is rated by EPA as LO-1; LO indicating that the EPA lacks any objections to all alternatives. The numerical rating of 1 indicates that EPA believes the information in the document is complete. A few suggestions for improvement of the DEIS are presented below. A summary of EPA's rating criteria is enclosed.

The AA/DEIS evaluates social, historical and environmental impacts of a range of alternatives: a baseline no build alternative, a Transportation System Management (upgrades of existing services, selected intersection and signal improvements), a low, medium and high investment Bus Rapid Transit (BRT; Alternatives 3, 4, and 5 respectively, with slightly different routes, amount of dedicated transitway, tunneling and grade separation), and a low, medium and high investment Light Rail Transit (LRT; Alternatives 6, 7, and 8 respectively, with different amount of tunneling and grade separation). Environmental impacts of each alternative are relatively low for a 16 mile transitway. Vegetative wetland impacts range for the build alternatives from 0.98 to 1.36 acres, open water from 0.17 to .2 acres, stream impacts from 3,892 to 5,662 linear feet, forest impacts of between 10.7 acres to 24.62 acres and park impacts range from 1.98 acres to 3.02 acres. The transitway crosses, or approaches, several important stream valley parks including Rock Creek, Sligo Creek, Northwest Branch, Paint Branch, Northeast Branch and Brier Ditch. The AA/DEIS could be improved by clarifying park names in Figure 4.4-1 and more easily correlating the figure to the data tables (reference to Table 4.4-2 on the figures is incorrect; it seems to be done correctly within the Natural Resources Technical

Report). Impacts to resources are minimized as the transitway follows existing roadway or former rail guideway. Further minimization of impacts to streams, floodplains and wetlands should be pursued through design, and be included as a consideration in selection and design of the required project maintenance facility sites. Design, or right-of-way purchase, that can protect or enhance stream buffer or floodplain function may be considered.

Environmental Justice (EJ) analysis identified populations of concern and benefits to the community. It is not clear how evaluation of potential disproportionate impacts, which was concluded to not be anticipated, were made. There is a need to specify the impacts that will occur within the EJ communities, and explain the efforts to address impacts. Residential displacements throughout the corridor should be clearly summarized in the document (reference to Table 3-6 in the Socioeconomic Technical Report would be useful or addition of a simplified summary). A short indirect and cumulative effects (ICE) analysis was provided in the document. Discussion of cumulative effects could be improved by indicating specific foreseeable projects planned in the area of the ICE study boundary (or reference the page where the information can be found, such as in the Socioeconomic Technical Report) and their potential impact to resources (cultural or natural) that are affected by the proposed project. Trend analysis of the resources of concern was not discussed for the selected timeframe of the ICE study.

Conceptual mitigation discussed in the AA/DEIS and Natural Resources Technical Report is reasonable, and will need to be developed in coordination with appropriate regulatory agencies in more detail as the project progresses. Potential replacement of currently used trails should be clearly presented (or reference made to pages or figures where information can be found in technical reports). EPA will be pleased to participate in the development of mitigation. EPA supports evaluation and incorporation of design that can potentially reduce environmental impacts such as pervious surface for the LRT transitway, low impact development BMPs for park and rides (or kiss-and-rides) that may be included in the infrastructure project, research into low emissions vehicles for the BRT option (possibility of partial zero emissions hybrid buses), and low emissions equipment use during construction.

Thank you for providing EPA with the opportunity to review this project. If you have questions regarding these comments, the staff contact for this project is Ms. Barbara Rudnick; she can be reached at 215-814-3322.

Sincerely,

for William Arguto
NEPA Team Leader
Office of Environmental Programs

Enclosure

RATING THE ENVIRONMENTAL IMPACT OF THE ACTION

- **LO (Lack of Objections)** The review has not identified any potential environmental impacts requiring substantive changes to the preferred alternative. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposed action.
- **EC (Environmental Concerns)** The review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact.
- **EO (Environmental Objections)** The review has identified significant environmental impacts that should be avoided in order to adequately protect the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). The basis for environmental Objections can include situations:
    1. *Where an action might violate or be inconsistent with achievement or maintenance of a national environmental standard;*
    2. *Where the Federal agency violates its own substantive environmental requirements that relate to EPA's areas of jurisdiction or expertise;*
    3. *Where there is a violation of an EPA policy declaration;*
    4. *Where there are no applicable standards or where applicable standards will not be violated but there is potential for significant environmental degradation that could be corrected by project modification or other feasible alternatives; or*
    5. *Where proceeding with the proposed action would set a precedent for future actions that collectively could result in significant environmental impacts.*
- **EU (Environmentally Unsatisfactory)** The review has identified adverse environmental impacts that are of sufficient magnitude that EPA believes the proposed action must not proceed as proposed. The basis for an environmentally unsatisfactory determination consists of identification of environmentally objectionable impacts as defined above and one or more of the following conditions:
    1. *The potential violation of or inconsistency with a national environmental standard is substantive and/or will occur on a long-term basis;*
    2. *There are no applicable standards but the severity, duration, or geographical scope of the impacts associated with the proposed action warrant special attention; or*
    3. *The potential environmental impacts resulting from the proposed action are of national importance because of the threat to national environmental resources or to environmental policies.*

RATING THE ADEQUACY OF THE DRAFT ENVIRONMENTAL IMPACT STATEMENT (EIS)

- **1 (Adequate)** The draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.
- **2 (Insufficient Information)** The draft EIS does not contain sufficient information to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the proposal. The identified additional information, data, analyses, or discussion should be included in the final EIS.
- **3 (Inadequate)** The draft EIS does not adequately assess the potentially significant environmental impacts of the proposal, or the reviewer has identified new, reasonably available, alternatives, that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant

- RECORD #1574 DETAIL

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- RECORD #2224 DETAIL

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Zip Code :	
Email Address :	
Submission Content/Notes :	
Attachments :	Wrttn Tstmny. L. Barnes.pdf (2 mb)

The Town of Chevy Chase

I am Linna Barnes, member of the Town of Chevy Chase Council and former Mayor. I appreciate the opportunity to present comments to the hearing panel and the Town will be submitting formal written comments prior to January 14, 2009.

The Purple Line's two primary goals are to create a more efficient transportation system and to encourage economic development. While we applaud these goals in concept, we are extremely concerned that the State, by designing an east west connection that potentially costs $1.6 billion dollars, is putting all its eggs in one transportation basket when the transportation needs throughout Montgomery County, and the rate of growth north of Bethesda in particular, are astounding. According to the highway Mobility Report, May 2008 put out by the Maryland National Park and Planning Council, two-thirds of the forecasted growth is anticipated in the northern half of the I-270 corridor, but other high growth locations include the Naval Medical Center and the White Oak facilities of the Food and Drug Administration.

Some of the transportation needs we feel could be jeopardized by an expensive Purple Line include:

- The Corridor Cities Transitway that will remove thousands of cars from I-270 daily, improve commute times and provide needed transit options to such burgeoning transit-oriented communities such as Germantown and Clarksburg.

- Rockville Pike at North Bethesda Town Center – where a 1.2 million square foot project is planned on 32 acres and at the White Flint Mall area where major development is also planned. Anyone who has driven the Pike knows it is already beyond congested. We commend Marc Elrich for taking the lead on developing a creative use of bus rapid transit for the area and would urge the county to explore his proposed system further and move quickly to implement it.

- The BRAC action relocating Walter Reed to National Naval Medical Center where 4,000 new visits are expected daily. State, local and federal assistance for alleviating projected congestion seems piecemeal and inadequate at best.

4301 Willow Lane • Chevy Chase, Maryland 20815 • 301/654-7144 • Fax 301/718-9631 • townoffice@townofchevychase.org
www.townofchevychase.org

The report I mentioned earlier notes that of the 10 most congested intersections in the county, several are in this part of the county (Conn and East/West Highway, Conn and Jones Bridge, Rockville Pike and Cedar Lane). A Purple Line that connects to Bethesda on the Master Plan alignment will only help with congestion at one of those interactions; the Jones Bridge Road Bus Rapid Transit could help with all three.

In looking at the DEIS, we are extremely concerned that the full costs for light rail on the Master Plan alignment are not fully articulated and we will be requesting further documentation of those costs. We are also concerned about the actual costs to the county not only for the building of the line but longer term costs for maintenance and operations. We would like to know how the State was able to keep the high end LRT costs at $1.6 billion, when they were originally projected to be between $1.6 and $1.75. It is all but a little suspect because the $1.6 billion puts the cost effective measurement at $23.71, just under the $24 FTA threshold.

We call upon our elected officials to show real leadership – fiscal responsibility, creativity in finding solutions to today's transit needs and in planning for tomorrow's. It is time to modify a nearly 20 year old plan -- we really can't afford one glitzy project that State studies have shown will primarily just shift people from one transit mode to another so we can get between point a and point b quicker. The transit needs in this county are enormous. Yesterday's high-end Purple Line dream should not soak up the dollars needed to address tomorrow's real transit needs around the County.

- RECORD #1321 DETAIL

First Name :	Treasurer Linna
Last Name :	Barnes
Business Name :	Town of Chevy Chase
Address :	
City :	
State :	MD
Zip Code :	
Email Address :	

Submission Content/Notes : Linna, L-I-N-N-A, Barnes, B-A-R-N-E-S. Good evening. I'm Linna Barnes and I'm a council member in the town of Chevy Chase and also a former mayor. I really appreciate this opportunity to come to you, before you tonight and present these comments.

What I want to focus on is some of the consequences to the county as a whole. The Purple Line's two primary goals are to create a more effective transportation system and to encourage economic development. We applaud these goals but we are extremely concerned that the state, by designing an east-west connection, that potentially costs 1.6 billion dollars, is putting all its eggs into one transportation basket. When the transportation needs, throughout Montgomery County, and the rate of growth, north Bethesda, in particular, are astonishing.

According to Park and Planning, the national, Maryland National Park and Planning Council, two-thirds of this forecasted growth is anticipated in the northern half of the I-270 corridor and other high-growth areas include the Naval Medical Center and the White Oak facilities. We feel that there are transportation needs that must be addressed when the state is looking at all the counties needs. There's a Carter City Transitway that will remove traffic from I-270 daily, improve commute times, and provide needed transit options to the burgeoning transit-oriented community, such as Germantown and Clarksburg.

There's also the Rockville Pike area at North Bethesda Town Center, where 1.2 million square foot of project is planned on acres. And at the White Flint Mall area, where major development is also planned. We commend Mark Elridge for for taking the lead on developing a creative use of bus rapid transit in these areas and the county as a whole that will provide options.

The other obviously major area of growth is the Naval Medical Center. You just heard from the councilwoman from New Carrollton talk about her parents wanting to come there because they will no longer be going to Walter Reed. We believe that a one seat ride is a much better option for these people coming to go to the Naval Medical Center. It will provide a much more smooth ride for these people and to do that, you really need to look much more thoroughly at option number 6, which is the Jones Bridge Rapid Transit, Bus Rapid Transit.

And looking at this DEIS, we're extremely concerned that the full cost for the light rail of the Master Plan alignment are not fully articulated and we will be requesting further documentation of those costs.

We are also concerned that the actual cost of the county are not being full accounted for. We would like to know how the state was able to keep the high end LRT at 1.6 billion, when they had originally projected the cost to be between 1.6 and 1.75 billion. All of this is a little bit suspect when you look at what this brings the cost down for the cost-effective measurement will come in at 23.71 dollars and the, the transit threshold is 24 dollars.

Finally, we're calling on our elected officials to show real leadership, fiscal responsibility, creativity in finding solutions to today's transit needs and in planning for tomorrow's. It is time to modify a nearly 20-year-old plan.

We really can't afford one glitzy project that the state's, that state studies have shown will primarily just shift people from one transit mode to another so that we can get between a point to point, point A to point B quicker. The transit needs in this county are enormous.

Yesterday's high-end Purple Line dream should not soak up the dollars needed to address tomorrow's real transit needs around the county. Thank you for giving us this time to talk to you.

- RECORD #1086 DETAIL

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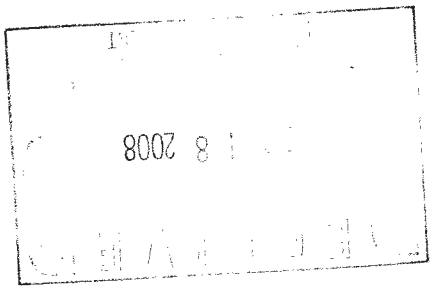

December 15, 2008

Transportation Secretary John D. Porcari
Office of Secretary
Department of Transportation
7201 Corporate Center Drive
Hanover, MD 21076

PURPLE LINE MPIA REQUEST

Dear Secretary Porcari:

This is a request under the Maryland Public Information Act, State Government Article §§10-611 to 628. I am making this request on behalf of the Town of Chevy Chase. In this capacity, I request access to and copies of the following information used to prepare the Maryland Transit Administration's Purple Line Alternatives Analysis/Draft Environmental Impact Statement:

1. Electronic workpapers in spreadsheet formats that detail the development of the annual incremental O&M expenses included in Tables 4-7 and 4-8 of the O&M Technical Report.

2. Any spreadsheets or materials documenting the link between the statistics shown in Table 4-6 of the O&M Technical Report to the statistics used to develop the annual incremental O&M Expenses in the same report.

3. Electronic copy of the cost information database used to develop the capital costs for each alternative as described in Sections 4.2.3 and 4.2.4 of the Capital Cost Report, including all links to the UCL and links to any separate databases which contain the quantity and units for each transit alternative.

4. Electronic copy of the cost information database used to develop the capital costs for each alternative as described in Sections 4.2.3 and 4.2.4 of the Capital Cost Report, including all links to the UCL and links to any separate databases which contain the quantity and units for each transit alternative.

5. Electronic workpapers used to develop the capital cost estimates shown in Table 6-1 of the Capital Cost Report.

6. Electronic workpapers used to calculate the Annualized Capital Costs shown in Table 6-3 of the DEIS.

7. Electronic workpapers used to develop the Annualized Cost Per Hour of Unit Benefits shown in Tables 6-2 and 6-3 of the DEIS.

8. Electronic workpapers used to develop the Annualized Cost Per New Rider Relative to the No Build Alternative shown in Table 6-2 of the DEIS.

9. The AECOM Transit original mode choice calibration report, including all mode choice coefficient values.

10. To the extent that the MTA recalibrated the MWCOG/AECOM Transit model, please provide the calibration report, including all mode choice coefficient values.

11. All workpapers supporting the figures shown in Table 3-58 ("NonIncluded Attributes") in the Travel Demand Forecasting Technical Report.

12. For each alternative described in Section 2 of the Travel Demand Forecasting Technical Report, please provide the zonal walk times and percent walk to transit included in the AECOM Transit model input files.

13. Electronic workpapers in spreadsheet formats that detail the annual change in Systemwide Farebox Revenues included in table 5-2 of the Purple Line Alternatives Analysis Draft Environmental Impact Statement ("DEIS").

If all or any part of this request is denied, I request that I be provided with a written statement of the grounds for the denial. If you determine that some portions of the requested records are exempt from disclosure, please provide me with the portions that can be disclosed.

I also anticipate that I will want copies of some or all of the records sought. Therefore, please advise me as to the cost, if any, for obtaining a copy of the records and the total cost, if any, for all the records described above. If you have adopted a fee schedule for obtaining copies of records and other rules or regulations implementing the Act, please send me a copy.

I look forward to receiving disclosable records promptly and, in any event, to a decision about all of the requested records within 30 days. Thank you for your cooperation. If you have any questions regarding this request, please telephone me at the above number.

Thank you for your assistance.

Sincerely,

Stacey L. Wilson

cc: Mr. Michael D. Madden
Chief, Project Development
Office of Planning
Maryland Transit Administration

- RECORD #1361 DETAIL

First Name :	Lawerence
Last Name :	Hirsh
Business Name :	Village of N. Chevy Chase
Address :	3601 Iverness Dr
City :	Chevy Chase
State :	MD
Zip Code :	20815
Email Address :	

Submission Content/Notes :

Hello, my name is Lawrence Hirsh. Spelled L-A-W-R-E-N-C-E, last name is H-I-R-S-H. I live in the village of North Chevy Chase. I'm also a member of the council that governs that village. And I am here today to identify that the Village of North Chevy Chase has approximately 200 homes and we are adjacent to Jones Bridge Road and Connecticut Avenue. We are very sensitive the current level of traffic that we have today.

And speaking for myself and for a number of the neighbors, we're very concerned about the traffic that will evolve in the area related to population growth, economic development, BRAC, there are a host of issues we've heard them say. I won't go through all of those. But I am a concerned citizen. I'm glad to have the opportunity to speak with this group.

So traffic today on Jones Bridge Road and on Connecticut Avenue is close to untenable. I drive that just about every day and it concerns me greatly to imagine a future where we have even more traffic on either Connecticut Avenue or Jones Bridge Road. To me, that seems, that seems untenable, unrealistic, and I can't imagine how that could be made feasible.

I have concerns also if, if we were to, sorry, I'm chewing my words, if we were to have BRT on Jones Bridge Road, I have great concerns that we would have increased incidents of pedestrian accidents with residents of the neighborhoods on either side of Jones Bridge Road who walk and of the students of the elementary school, North Chevy Chase. So, I have great concerns over the safety of the community and the impact of BRT on Jones Bridge Road.

I'm a huge supporter of the Purple Line in general and I'm personally a supporter of LRT. Almost any of the options of light rail. In my opinion, BRT is simply not a viable option. If it seems reasonable to me that if LRT is even remotely similar environmentally to BRT, which, the DEIS proves that it is, it would be crazy to add traffic onto the streets when we have a viable option to take traffic off of the streets. That's my closing argument. Thanks.

- RECORD #2868 DETAIL

First Name :	
Last Name :	
Business Name :	Maryland State Clearinghouse
Address :	301 West Preston Street, Suite 1101
City :	Baltimore
State :	MD
Zip Code :	21201-2305
Email Address :	
Submission Content/Notes :	
Attachments :	Maryland State Clearinghouse.pdf (2 mb)

Maryland Department of Planning

Martin O'Malley
Governor
Anthony G. Brown
Lt. Governor

Richard Eberhart Hall
Secretary
Matthew J. Power
Deputy Secretary

January 14, 2009

Mr. John Newton
Manager Environmental Planning
Maryland Transit Administration
6 St. Paul Street
Baltimore, MD 21202-1614

STATE CLEARINGHOUSE RECOMMENDATION

State Application Identifier: MD20081016-1012
Applicant: Maryland Transit Administration (MTA)
Project Description: Purple Line Alternatives Analysis/Draft Environmental Impact Statement (DEIS): consider "six" build alternatives; no build alternative; and Transportation Systems Management alternative
Project Location: Montgomery and Prince George's Counties
Approving Authority: U.S. Department of Transportation
Recommendation: **Consistent with Qualifying Comments and Contingent Upon Certain Actions**

Dear Mr. Newton:

In accordance with Presidential Executive Order 12372 and Code of Maryland Regulation 14.24.04, the State Clearinghouse has coordinated the intergovernmental review of the referenced project. This letter, with attachments, constitutes the State process review and recommendation based upon comments received to date. This recommendation is valid for a period of three years from the date of this letter.

Review comments were requested from the Maryland Departments of the Environment, Public Safety and Correctional Services, Natural Resources, Budget & Management, Business and Economic Development, General Services, Health & Mental Hygiene, Housing and Community Development, the Maryland State Department of Education, the University System of Maryland; Montgomery and Prince George's Counties, the Maryland-National Capital Park and Planning Commission in Montgomery, and Prince George's Counties, the Metropolitan Washington Council of Governments, the Cities of College Park, New Carrollton, and Takoma Park; the Towns of Chevy Chase, and Riverdale Park, and the Maryland Department of Planning, including the Maryland Historical Trust. As of this date, the Maryland Departments of Natural Resources, the Maryland-National Capital Park and Planning Commission in Montgomery and Prince George's Counties, the Town of Riverdale Park, the Cities of New Carrollton, and College Park have not submitted comments. **This recommendation is contingent upon the applicant considering and addressing any problems or conditions that may be identified by their review. Any comments received will be forwarded.**

Prince George's County, the Town of Chevy Chase, and the Maryland Historical Trust stated that their findings of consistency are contingent upon the Applicant taking the actions summarized below. Prince George's County addressed these issues: its strong support for light rail as the preferred alternative; construction of the Line to New Carrollton and not under a deferred basis as a condition of the County's contribution of local funds for the project; lacking the provision of a dedicated lane for the project, the State Highway Administration should be responsible for road maintenance of Paint Branch Parkway (from US 1 to River Road); consultation with the Maryland-National Capital Park and Planning Commission in Prince George's County and full local match funding for the transferring of a site in the County for a light-rail maintenance garage; greater consideration of added design elements of the Prince George's County portion of the project; and adding future extension capabilities into the Line as part of the design of the New Carrollton Station. See the attached memorandum.

The Town of Chevy Chase supported the Purple Line concept, but stated that the review document contains certain deficiencies that should be addressed by Maryland Transit Administration, and included in the creation of a Supplemental Draft Environmental Impact Statement. The Town of Chevy Chase stated that the DEIS lacks "a full and fair evaluation of the Low Investment Bus Rapid Transit Alternative."

In a section of the Town of Chevy Chase's comments entitled "The Alternatives Analysis/Draft Environmental Impact Statement Does Not Fairly Evaluate the Base Realignment and Closure 'BRAC' Benefits of Low Investment Bus Rapid Transit", the Town states that "the Alternatives Analysis/Draft Environmental Impact Statement ignores the benefits of the Low Investment Bus Rapid Transit Alternative in addressing and mitigating the traffic and other impacts of the relocation of Walter Reed Army Hospital (in Washington, D.C.) to the National Naval Medical Center (NNMC - in Bethesda). The relocation of Walter Reed will bring a significant influx of employees and visitors to this location" who could benefit by the "direct access to NNMC" provided by the Low Investment Bus Rapid Transit Alternative. See the enclosed letter, and attachments.

The Maryland Historical Trust (MHT) recommended that the Maryland Transit Administration, and the Federal Transit Administration successfully complete the Section 106 review in consultation with MHT.

The Maryland Departments of Housing and Community Development; and the Environment; Montgomery County; the University System of Maryland; and the Maryland Department of Planning found this project to be generally consistent with their plans, programs, and objectives, but included certain qualifying comments summarized below. The Maryland Department of Housing and Community Development seeks "to ensure that affordable housing options are available along any proposed route."

The Maryland Department of Housing and Community Development mentioned that "it would like to ensure that affordable housing options are available along any proposed route."

The Maryland Department of the Environment submitted these qualifying comments.

1. Removal of any above ground or underground petroleum storage tanks must be conducted in accordance with applicable State and federal laws and regulations. Contact the Oil Control Program at (410) 537-3442 for additional information.

2. Any solid waste including construction, demolition and land clearing debris, generated from the subject project, must be properly disposed of at a permitted solid waste acceptance facility, or recycled if possible. Contact the Solid Waste Program at (410) 537-3318 for additional information.

Montgomery County stated that other than "the Jones Bridge Bus Rapid Transit alternative, which is not consistent with the Master Plan, it supports the Purple Line. Any alternative with at-grade crossings must not impede the ability for fire and rescue apparatus to respond to emergencies. Any moderately-priced housing lost to an alignment should be replaced."

This Department submitted the following comments. "Other than Alternative 1 - No-Build, and Alternative 2 – TSM (Transportation System Management) which are inconsistent with the State smart growth policies, the Purple line from Bethesda (in Montgomery County) to New Carrollton (in Prince George's County) is consistent with the Maryland Economic Growth, Resource Protection, and Planning Policies, and the Smart Growth and Neighborhood Conservation Policy. The Project would provide a high-quality transitway as an alternative to automobile travel, and help to reduce regional congestion and benefit the environment. The project would provide viable transportation for minority (65% of the total population in the study area) or low-income (12% of the total population in the study area) population, and serve as a catalyst for potential transit-oriented revitalization and development along the Purple Line corridor. The Purple Line corridor is located entirely within the Priority Funding Areas of Montgomery, and Prince George's Counties.

A high-quality, build alternative will provide a much-needed transportation alternative in the Washington D.C Region to help achieve the State, regional and local transportation and smart growth land use goals.

This Department strongly believes that the Purple Line would promote the efficient use of lands within Priority Funding Areas.

The following are specific comments on the DEIS, provided so that these items will be addressed in the Final Environmental Impact Statement.

- Page 1-14, Land Use Plans and Policies
  The Transportation Management Districts (TMDs) policy in Montgomery County should be mentioned. This policy affects employers with 25 or more full- or part-time employees in Downtown Bethesda, North Bethesda, Downtown Silver Spring, and Friendship Heights. These are the County's Transportation Management Districts (TMDs). More information can be found at http://www.montgomerycountymd.gov/mcgtmpl.asp?url=/Content/DPWT/Transit/commuter/tmdlegislation.asp

- Page 2-28, 2.4.11. Stations and Station Facilities
  This Department noted that there are no new park-and-ride facilities as part of the Purple line. The existing parking garage locations near the Bethesda and Silver Spring Metro Stations, and at the College Park and New Carrollton Metro Station, as well as, potential kiss-and-ride facilities should be mapped out, and data provided about parking capacity for each facility.

- Page 3-17, 3.3. Pedestrian and Bicycle Access
  This Department recommended that the Final Environmental Impact Statement include a map showing Bicycle and Pedestrian Facility locations including the existing Bicycle and Trail Network, as well as, Planned Bicycle and Trail networks.

- Page 4-2, 4.1.2 Land Use
  Overall, the Transit-Oriented Development (TOD) discussions in the DEIS reflect the approaches of the State, Montgomery, and Prince George's Counties. In addition, This Department suggested that the following information should be included:

  The State's TOD strategy and projects are described on this website: http://www.mdot-realestate.org/tod.asp. In addition, in 2008 Maryland passed TOD legislation that defines TOD as a transportation purpose. This law enables MDOT to use transportation funding to promote TOD in transit station areas (http://mlis.state.md.us/2008rs/billfile/sb0204.htm).

- It would be better to include a TOD section separately from the "Planned and Approved Development" section.

- This Department recommended that the FEIS include a map of the locations of proposed developments with total gross building areas, and the type of proposed developments in the corridor (i.e. office, commercial uses). It will indicate a clearer relationship between any proposed developments (land use), and the construction of the Purple Line (transportation).

- Page 4-13, 4.3.3. Effects on Minority and Low Income Populations
  The impacts of potential gentrification, and mitigation strategies should be discussed. Building the Purple Line would bring positive development and redevelopment opportunities to minority and low-income neighborhoods in the future. However, gentrification could occur along with the new development. Revitalization efforts in minority and low-income neighborhoods should implement strategies to mitigate negative effects on neighborhood residents. Such strategies include: providing affordable housing, job training, and incentives for hiring neighborhood residents. The State should work with Montgomery and Prince George's Counties to provide job training and priority hiring practices for residents in the corridor of the Purple Line construction project.

The University System of Maryland commented that it "and the University of Maryland College Park are aware of this project, and are working closely with MTA and will continue to do so."

The Maryland Departments of Health & Mental Hygiene, Public Safety and Correctional Services, Business and Economic Development, and Budget & Management; General Services, the Maryland State Department of Education, the Metropolitan Washington Council of Governments; and the City of Takoma Park found this project to be consistent with their plans, programs, and objectives.

The City of Takoma Park submitted City Council Resolution 2008-86. See the attached Resolution that expresses the City's support for the medium investment, light-rail transit option as the alternative that it recommends for submission to the Federal Transit Administration.

Any statement of consideration given to the comments should be submitted to the approving authority, with a copy to the State Clearinghouse. The State Application Identifier Number must be placed on any correspondence pertaining to this project. The State Clearinghouse must be kept informed if the approving authority cannot accommodate the recommendation.

Please remember, you must comply with all applicable state and local laws and regulations. If you need assistance or have questions, contact the State Clearinghouse staff person noted above at 410-767-4490 or through e-mail at brosenbush@mdp.state.md.us. **Also please complete the attached form and return it to the State Clearinghouse as soon as the status of the project is known.** ***Any substitutions of this form must include the State Application Identifier Number.*** **This will ensure that our files are complete.**

Thank you for your cooperation with the MIRC process.

Sincerely,

Linda C. Janey

Linda C. Janey, J.D., Assistant Secretary
for Clearinghouse and Communications

LCJ:BR
Enclosures
cc: Beth Cole - MHT
Barbara Bice - MSDE
Joane Mueller - MDE
Cindy Johnson - MDOT
David Bezanson - DPSCS
Greg Golden - DNR
Chadfield Clapsaddle - DBM
Tammy Edwards - DBED
Gerry Krebs - DGS
Elizabeth Barnard - DHMH
John Griener - DHCD
Diane Jones - MTGM
Beverly Warfield - PGEO
John Carter - MNCPPCM
Betty Carlson-Jameson - MNCPPCP
Greg Goodwin - MWCOG
Bruce Williams – TAKOMA PARK
Kathy Strom – CHEVY CHASE
Stephen Brayman – COLLLEGE PARK
Vernon Archer – RIVERDALE PARK
Andrew Hanko – NEW CARROLLTON

08-1012_CRR.CLS.doc

Jack B. Johnson
County Executive

PRINCE GEORGE'S COUNTY GOVERNMENT

DPW&T

Department of Public Works and Transportation
Office of the Director

MEMORANDUM

Date: January 9, 2009

To: Beverly G. Warfield, Special Assistant for Regulatory Affairs, Environmental Services Division, DER

From: Haitham A. Hijazi, Director

Re: TSM-A-95 Clearinghouse Review - Purple Line
MD 20081016-1012

The Department of Public Works and Transportation (DPW&T) has reviewed the above referral and has the following comments:

Prince George's County strongly supports the Purple Line project. However, to fully serve the needs of its citizens and residents, the County feels that the project must use Light Rail as the preferred alternative. Light Rail has the greater ability to provide faster service, attract increased ridership, reduce the largest number of single occupancy vehicle trips, provide higher capacity and; therefore, better long-term value and effectiveness and maximum economic benefit.

While Maryland Transit Administration (MTA) officials say that there is no intent to construct the Purple Line in phases, they do frequently point out that the College Park to New Carrollton segment has the lowest projected ridership. Prince George's County will only support the Purple Line with local funding if it is constructed to New Carrollton and not under a deferred basis.

The MTA has made clear they desire an alignment in a shared lane on Paint Branch Parkway going under the CSX Bridge. DPW&T has expressed opposition to a shared lane and has said that if the MTA does not provide a dedicated lane, road maintenance for Paint Branch Parkway from US 1 to River Road should become the responsibility of the State Highway Administration (SHA).

A potential site for a light rail maintenance garage has been identified in Prince George's County. Final resolution of this site should be concluded between MTA and the Maryland-National Capital Park and Planning Commission (MNCPPC). The County should be awarded full local match funding for all relevant costs involved in transferring this site to MTA and relocating the MNCPPC maintenance garage.

We are concerned about the level of design included in the DEIS for the segment in Prince George's County and note that a significant gap in design exists when compared to the segment in Montgomery County. A few examples of MTA not studying elements in detail nor including Prince George's County in the DEIS are as follows:

- Dedicated lane use for transit on Paint Branch Parkway and a new CSX Bridge.
- An aerial crossing of the intersection of Kenilworth Avenue (MD 201) and East-West Highway/Riverdale Road (MD 410).
- Dedicated lane use along the south side of MD 410 from 58th Avenue to Veterans Parkway.
- A more equitable cost and benefit distribution for each segment and a more even environmental mitigation measure distribution.
- Classification of design elements do not appear to be consistent. For example, a BRT/LRT separated grade crossing on Connecticut Avenue is listed as a medium element, yet a grade separation crossing on Annapolis Road is considered only as a high element even with favorable topographic conditions.

Greater consideration of added design elements to the Prince George's County portion like bike/pedestrian facilities, grass tracks and other amenities as have been afforded to the Montgomery County portion should be given.

Design of the New Carrollton Station must be done in a fashion to accommodate a future extension of the Purple Line as a one seat ride to Oxon Hill.

The FTA looks to determine state/local commitment by project inclusion in the Region's Constrained Long Range Plan (CLRP). Currently, the Purple Line segment from Silver Spring to New Carrollton is not in the CLRP. We understand that it is important for inclusion prior to the selection of a Locally Preferred Alternative (LPA), which is scheduled to take place in a couple of months. This exclusion in the CLRP should not prevent the Prince George's County segment to move forward as a part of or as the initial segment of the Purple Line to be constructed.

If you have further questions regarding the above, please contact Franklin Bell, Transit Planning Section, at (301) 883-5656.

HAH/VW/dc

cc: J. Rick Gordon, Acting Deputy Director
Vic Weissberg, Special Assistant to the Director
James Raszewski, Chief, Transit Division
Franklin A. Bell, Transit Planning Section

MD20081016-1012

Introduced By: Councilmember Wright

Resolution No. 2008 -86

Resolution Recommending Funding the Purple Line Medium Investment Light Rail Transit Alternative

WHEREAS, the State of Maryland has completed studying the alignment and mode alternatives for the Purple Line and has written the Alternatives Analysis/Draft Environmental Impact Statement; and

WHEREAS, the State of Maryland, with input from the community, city and county governments, and elected officials, will be deciding which mode and alignment and phasing of three projects the State may request funding for: the Purple Line, the Corridor City Transitway and/or the Baltimore Red Line; and

WHEREAS, fiscal, environmental, and economic sustainability are goals of the City of Takoma Park; and

WHEREAS, a livable community that is vibrant, healthy, and safe with convenient transportation for all of its residents is also a goal of the City; and

WHEREAS, the Purple Line, as proposed, would have three stops near Takoma Park that will serve residents, improve access to local businesses and provide an incentive for transit-oriented development: one at Arliss Street and Piney Branch Road ("Arliss Street"), one at University Boulevard and Gilbert Street ("Gilbert Street"), and one at University Boulevard and New Hampshire Avenue ("Takoma/Langley Crossroads"); and

WHEREAS, the population living in the vicinity of the proposed Purple Line is more transit dependent than other areas in Montgomery County; and

WHEREAS, the Purple Line would directly connect many transit dependent residents in Montgomery County and Prince George's County with important regional employment centers including New Carrollton, the University of Maryland, Silver Spring and Bethesda; and

WHEREAS, the Purple Line would also connect residents to the Metrorail Red, Green and Orange Lines; the MARC Brunswick, Camden and Penn Lines; Amtrak; and regional and intercity bus lines; allowing convenient access throughout the region; and

WHEREAS, there are many bus riders along the proposed Purple Line route whose commute time will become shorter, increasing their quality of life and expanding their employment opportunities; and

WHEREAS, the Takoma Park City Council has long supported light rail transit as the mode most beneficial for Takoma Park residents and business owners; and

WHEREAS, light rail transit may be provided in short train configurations allowing for much greater ridership capacity than bus rapid transit, which is provided by single car vehicles; and

WHEREAS, the estimated average travel time between Bethesda and Adelphi will be 31 minutes for the medium investment light rail Purple Line alternative and 40 minutes for the medium investment bus rapid transit Purple Line alternative; and

WHEREAS, the medium investment bus rapid transit alternative will share travel lanes to a much greater extent than the medium investment light rail alternative, and will therefore be more susceptible to delays due to traffic congestion; and

WHEREAS, residents of the Washington, D.C. region are comfortable with, and heavy users of, the area's existing rail transit system, and have a positive image of rail transit; and

WHEREAS, it is in the community's interest to invest in a light rail transit system, since it would allow for high ridership capacity and is faster and less subject to disruption than a bus rapid transit system; and

WHEREAS, installation of light rail infrastructure provides a clear signal to commercial property owners and investors of a permanent commitment to a transit route and station, encouraging investment in, and redevelopment of, properties adjacent to a light rail station, while bus rapid transit routes and stations are more easily moved, thus adding risk to commercial investment decisions; and

WHEREAS, the proposed light rail Purple Line will spur redevelopment of commercial properties in Takoma Park's priority redevelopment areas; and

WHEREAS, the Takoma Park Master Plan, approved and adopted in December 2000, recommends "tree-lined sidewalks, landscaped medians, and street trees in wide panels separating sidewalks from traffic" and "on-road bikeways and 'shared use paths' (8-foot to10-foot wide sidewalks) on both sides" of streets; and

WHEREAS, ample, shaded sidewalks separated from fast moving traffic by street trees would substantially improve transit rider access to the proposed Purple Line; and

WHEREAS, bicycle lanes would substantially improve the multi-modal connectivity of Takoma Park residents and businesses with other centers in our region; and

WHEREAS, the existing right-of-way and State Highway streetscape requirements only allow for a limited width of sidewalk with no trees or buffer and the plans for the Purple Line rely on the State Highway requirements; and

WHEREAS, greater right-of-way should be provided for so that there is enough room that sidewalks may be safe, comfortable, and inviting; and

WHEREAS, the addition of the proposed Purple Line will widen University Boulevard and Piney Branch Road roadbed by an additional minimum 20 feet of paved surface; and

WHEREAS, widening University Boulevard will make it more difficult for pedestrians to cross to the transit station and area businesses, and will take land from adjacent property owners; and

WHEREAS, careful review of the design of University Boulevard may result in alternative lane configurations or other creative design solutions that would reduce the amount of right-of-way needed, especially at the University Boulevard/New Hampshire Avenue intersection; and

WHEREAS, the areas around the proposed stops at Arliss Street, Gilbert Street, and Takoma/Langley Crossroads, are the foci of intensive revitalization efforts; and

WHEREAS, the tens of thousands of residents living near the proposed stops at Arliss Street, Gilbert Street and Takoma/Langley Crossroads are sorely in need of beautification, streetscape amenities, and facilities to improve public space and to allow people to walk to public transit in comfort; and

WHEREAS, these existing and new residents, shoppers, and businesses would greatly benefit from the beautification option of grass along the transit line tracks ("grass tracks"); and

WHEREAS, grass tracks will reduce storm water run-off into sensitive waterways, including Long Branch and Sligo Creek; and

WHEREAS, the land uses along the proposed Purple Line route include many amenities such as housing, employment, services, and retail and entertainment outlets, and the area has a substantial capacity for higher density mixed-use development near the proposed transit stops; and

WHEREAS, even with transit improvements, there is a need for more parking in the Takoma/ Langley Crossroads shopping and residential areas; and

WHEREAS, on-street parking is extremely important to the viability of street-facing commercial enterprises in transit-oriented mixed-use shopping districts; and

WHEREAS, in some of the Purple Line alternatives, parking will be lost in side lanes along University Boulevard; and

WHEREAS, the proposed Purple Line route along University Boulevard is a key east-west route linking residential areas with employment centers and transit stations in Montgomery and Prince George's County; and

WHEREAS, University Boulevard is already substantially congested and is destined to become even more congested over time as the region grows; and

WHEREAS, the low-investment Purple Line alternatives would not provide exclusive transit lanes and would have slower service and little incentive for residents to choose transit over a car; and

WHEREAS, the high-investment Purple Line alternatives would elevate the train or bus, creating walls that would divide communities on either side of University Boulevard without providing substantial travel time savings; and

WHEREAS, the medium investment bus rapid transit Purple Line alternative would not run in an exclusive lane, but would share the outside lane of University Boulevard with local buses, requiring the bus rapid transit vehicle to move into the adjoining traffic to pass the local buses picking up passengers at local stops; and

WHEREAS, the medium investment bus rapid transit alignment's use of the outside lane would preclude the use of this lane for future off-peak parking; and

WHEREAS, the medium investment light rail transit Purple Line alternative would operate in an exclusive lane, so that even when vehicle lanes are congested, the light rail vehicles would not be delayed, providing a substantial incentive for transit use; and

WHEREAS, the medium investment light rail transit alignment is in the center lanes of University Boulevard, allowing the outside lane to be used for off-peak parking; and

WHEREAS, all six of the alternatives are projected to meet the cost-effectiveness requirement of the Federal Transit Administration for funding through the New Starts program; and

WHEREAS, the light rail medium investment alternative has the second highest rating of Annual User Benefit (in hours) of the six alternatives, while having significantly lower capital costs than the alternative with the highest User Benefit; and

WHEREAS, the medium investment light rail alternative would reduce the region's Year 2030 daily vehicle trips by 17,253 and daily vehicle miles traveled by 183,603, while the medium investment bus rapid transit alternative would reduce the daily vehicle trips by 14,137 and 113,562, respectively; and

WHEREAS, development of the full Purple Line route from Bethesda to New Carrollton will provide the greatest access for Takoma Park residents to the region's existing transportation systems; and

WHEREAS, use of the Georgetown Branch right-of-way between Connecticut Avenue and the Bethesda Metro greatly reduces the amount of time it would take Takoma Park residents to reach Bethesda, since the travel time for this segment using the right-of-way would range from 2.4 to 5.5 minutes, based on the alternative chosen, as compared to 10.7 minutes if the right-of-way is not used; and

WHEREAS, of the six alternatives presented, the light rail transit medium investment alternative will provide the most efficient, convenient, safe, and healthy transportation and will do the best job of improving the fiscal, environmental and economic health of Takoma Park and our inner beltway region of the State of Maryland.

NOW, THEREFORE, BE IT RESOLVED THAT the City Council of the City of Takoma Park

1. Strongly urges the State to proceed with the submission of the full length of the Purple Line transit way to the Federal Transit Administration and to work for its funding and construction in the near term.

2. Strongly urges the Secretary of Transportation to select the medium investment light rail transit option as the Purple Line alternative to submit to the Federal Transit Administration.

3. Urges the provision for future installation of sidewalks of a width that maximizes pedestrian safety and mobility, shaded by trees and buffered from traffic along University Boulevard; either by taking, by easement or by voluntary acquisition of right-of-way, as appropriate.

4. At the same time, urges study of alternative lane configurations or other design solutions to minimize the amount of right-of-way needed to be taken from adjacent properties along University Boulevard.

5. Urges the use of grass tracks in areas such as Takoma/Langley Crossroads and Long Branch and urges the adoption of strict maintenance schedules for these green areas.

6. Urges the provision of on-street parking during non-peak periods in areas where it can be accomplished safely within the existing right-of-way, to support retail activities in adjacent properties.

7. Urges the Secretary of Transportation to work with the State Highway Administration to develop transit areas that will allow continued access to commercial properties in current development and future redevelopment via existing or future streets, intersections, curb cuts, left turn opportunities and traffic signals, while maintaining safety standards for pedestrians, bicyclists and automobiles; and urges the continuation of coordination and communication among the different governmental entities so the strongest possible plan emerges.

8. Expresses appreciation to the State of Maryland and the Maryland Transit Administration for the thorough and high-quality work that has been done by their staffs and consultants in planning the Purple Line transit way.

9. Expresses appreciation to the Executives and Councils of Montgomery County and Prince George's County for their strong support of the Purple Line transit way.

10. Urges the governments of Montgomery County and Prince George's County to support the medium investment light rail alternative of the Purple Line as the alternative that best serves the residents, institutions and businesses of the two counties now and in the long term.

Adopted this 17th day of November, 2008.

Attest:

Jessie Carpenter
City Clerk

- RECORD #2340 DETAIL

First Name :
Last Name :
Business Name : State Highway Administration
Address :
City :
State : MD
Zip Code :
Email Address :
Submission Content/Notes :
Attachments : SHA.pdf (245 kb)

Martin O'Malley, *Governor*
Anthony G. Brown, *Lt. Governor*

SHA State Highway Administration

John D. Porcari, *Secretary*
Neil J. Pedersen, *Administrator*

Maryland Department of Transportation

MEMORANDUM

TO: Ms. Diane Ratcliff, Director
Office of Planning, MTA

FROM: Gregory I. Slater, Director
Office of Planning and
Preliminary Engineering

DATE: January 9, 2009

SUBJECT: Purple Line Alternatives Analysis/Draft Environmental Impact Statement Comments

Thank you for the opportunity to comment on the Maryland Transit Administration's (MTA) Purple Line Alternatives Analysis/Draft Environmental Impact Statement (AA/DEIS) report. The Purple Line is a transit project that is proposed to connect Bethesda in Montgomery County and New Carrollton in Prince George's County. The State Highway Administration (SHA) would like to offer the following comments for your consideration:

- The purpose of this AA/DEIS report is to support local decision-making on the need for transit investments in the Purple Line corridor. No particular alignment alternative or transit mode has been chosen, thus limiting our ability to make specific comments at this time. Specific comments about alignments, right-of-way needs, etc. will be provided in the Final Environmental Impact Statement (FEIS) report. The MTA will develop the FEIS report after the Governor selects a Locally Preferred Alternative and the preliminary engineering work is completed.

- The AA/DEIS report is generally consistent with SHA plans, as we do not know the exact alignment at this time. In Prince George's County, once an alignment has been selected, it is likely to impact several project planning studies such as US 1 College Park Planning Study and the University of Maryland Access Improvement Study. In addition, state roadways such as MD 193, MD 410, etc. will likely be impacted. Crossing the University of Maryland College Park campus may also be challenging. Similarly, in Montgomery County, crossing state roads like MD 97 and Colesville Road in Silver Spring may also be equally challenging.

- A transit center is proposed at Langley Park in Prince George's County. Montgomery and Prince George's Counties are updating the Langley Park Sector Plan to take advantage of the proposed transit center. A comprehensive, well-coordinated transportation plan will need to be developed to account the proposed transit and highway improvement needs.

- A joint MTA/SHA design team will need to work closely to determine the impacts of the Locally Preferred Alternative to the state roadways in the preliminary engineering phase (the next phase).

- There is only a brief mention of the Intercounty Connector (ICC) in the report. The report states that the ICC will have a limited impact on traffic conditions for east to west movements in this area. Although it is outside the corridor, if the ICC significantly reduces travel time between Montgomery County and Prince George's counties, the ICC will likely have more than a minor impact on east/west traffic conditions within the Purple Line corridor.

- The report considers no future improvements to the Capital Beltway. The SHA is currently studying the Capital Beltway (the Capital Beltway Study) to improve its capacity by adding lanes or implementing managed lane concepts in the future (2030). We suggest that you consider noting this study in your AA/DEIS report for the Purple Line project. However, the Capital Beltway Study is on hold due to the current economic downturn.

- I understand that beside Mr. Shiva K. Shrestha, our Regional Planner, other SHA staff, including Ms. Sue Rajan, Project Manager; Ms. Kate Mazzara, Assistant District Engineer for Project Development; Mr. Brian Young, Assistant District Engineer for Traffic (Prince George's County); and Mr. Jeff Wentz, Assistant District Engineer for Traffic (Montgomery County); are also involved in the Purple Line project. They will continue to assist MTA staff and consultants on this project.

Thanks again for the opportunity to review the Purple Line AA/DEIS report. If you have any questions or need additional information, please contact Mr. Shiva K. Shrestha, SHA Regional Planner for Prince George's County, at 410-545-5667, toll-free 888-204-4828 or via email at sshrestha@sha.state.md.us.

cc: Mr. Eric Beckett, Assistant Regional Planner, SHA
Mr. Keith Bounds, Regional Planner, Maryland Department of Transportation
Ms. Mary Deitz, Chief of Regional and Intermodal Planning Division, SHA
Mr. Mike Madden, Project Manager, MTA
Ms. Reena Mathews, Regional Planner, SHA
Ms. Kate Mazzara, Assistant District Engineer for Project Development, SHA
Mr. Darrell Mobley, District Engineer, SHA
Ms. Carla Ragsdale, Assistant Regional Planner, SHA
Mr. Shiva K. Shrestha, Regional Planner, SHA
Mr. Dennis Yoder, Assistant Chief of Regional and Intermodal Planning, SHA
Mr. Brian Young, Assistant District Engineer for Traffic, SHA
Mr. Jeff Wentz, Assistant District Engineer for Traffic, SHA

- RECORD #3248 DETAIL

First Name :	
Last Name :	
Business Name :	University of Maryland
Address :	
City :	College Park
State :	MD
Zip Code :	
Email Address :	
Submission Content/Notes :	
Attachments :	Intro packet.pdf (7 mb) CampusVibration.pdf (17 mb) ExampleTrainVibration.pdf (14 mb) SurveyofAmbientMagneticFields.pdf (3 mb) Addendum.pdf (153 kb)

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January 9, 2009

Ms. Diane Ratcliff
MTA Director of Planning
6 St. Paul Street, 9th Floor
Baltimore, MD 21202

Dear Ms. Ratcliff:

I am pleased to provide the University of Maryland's comments on the Purple Line Project Alternatives Analysis/Draft Environmental Impact Statement.

The University looks forward to continuing the discussion with the MTA on the issues we have raised.

Sincerely,

Ann G. Wylie
Interim Vice President
for Administrative Affairs

Enclosure

cc: C. D. Mote, Jr., President, University of Maryland
William E. Kirwan, Chancellor, University System of Maryland
Clifford M. Kendall, Chairman, Board of Regents, University System of Maryland
Kenneth G. Holum, Chair, University Senate
Jonathan Sachs, President, Student Government Association
Anupama Kothari, President, Graduate Student Government

University of Maryland
Comments on the Purple Line Alternatives Analysis and
Draft Environmental Impact Statement
(AA/DEIS)

The Purple Line will benefit the University by providing enhanced access to educational and research resources for students and faculty and by enhancing access to the University for visitors including potential students, visiting faculty and research collaborators. Furthermore, it will assist in the development of the East Campus. For these reasons, the University supports the construction of the Purple Line.

The University of Maryland has reviewed the AA/DEIS. The report does not address the adverse impact that the Light Rail traffic will have on the University's research environment. The impact is known, measurable, and substantial. The Maryland Transit Authority must acknowledge the deleterious effects of electromagnetic interference and vibrations on sensitive research. The AA/DEIS must describe with particularity whether the MTA will eliminate or mitigate them to the level compatible with the University's long-term research mission and how it intends to do it and how it intends to maintain it over the life of the transit system.

Currently, the University enjoys the benefits of very "quiet" electromagnetic and vibration environments. It is compatible with the use of today's most sensitive instruments. These natural resources have enabled the University to successfully compete for cutting-edge science funding and rise as a national research powerhouse. The University presently attracts $400 million in annual grant and contract awards. This constitutes one-third of its educational funding. The environment that sustains this university mission must be guaranteed into the future.

In ordinary operation, mass transit, and Light Rail in particular, will generate changes in the local magnetic field of the Earth, producing electromagnetic interference (EMI). Light rail systems also produce ground vibrations, which, though not large enough to disturb people, can disturb sensitive instruments and precise observations and measurements. If not satisfactorily mitigated, EMI and vibration interferences from the Purple Line, singly and in combination, will create a "research dead zone" for sensitive measurements of up to many hundred feet on each side of the tracks through campus. The research dead zone of the proposed Campus Drive alignment spans the core of the University's existing laboratories and research facilities that use these highly sensitive instruments and includes potential future building sites.

The University hired nationally recognized consultants to measure our current research environment with respect to EMI and vibrations. They have conducted similar analyses at other national universities that are planning for transportation systems operating in their proximity. This is a known and common national issue which is being addressed by the University of Washington, Washington University at St. Louis, and the University of Colorado Medical Center, among others. The consultants made measurements along the proposed Purple Line alignments through campus. They have predicted the impact of Light Rail based on the equipment and operations consistent with that described in the AA/DEIS. Three reports have been prepared: *Survey of Ambient Magnetic Fields on the University of Maryland Campus* (October 6, 2008),

Campus Vibration and Noise Ambient Environment (October 14, 2008), and *Example Train Vibration Predictions* (December 9, 2008). MTA consultants were present during these studies. The data and these reports have been shared with them. Copies are included with these comments.

The conclusion, drawn from the data in these University studies and the specifications of existing research equipment, is that the transit of Light Rail trains through campus will prohibit the use of existing equipment that is sensitive to magnetic field fluctuations and/or vibrations within a "dead zone" on each side of the tracks because the levels of EMI and vibration generated will be greater than the tolerances of the equipment. There will be a dead zone, but its size depends in part on the type of train system and the mitigation techniques used and in part on the operation and maintenance of the Light Rail system into the future. The location of the dead zone depends on the alignment selected. All these issues are critical to any Light Rail system planned for use near buildings that house or will house equipment sensitive to ground vibration and EMI effects, especially with a permanent alignment.

Electromagnetic Interference

Fluctuations in Earth's magnetic field interfere with the operation of scientific instruments that utilize charged beams or high-precision magnet systems. These instruments include the basic tools of modern research such as electron microscopes, electron beam lithography systems, focused ion beams, and systems requiring a very stable magnetic field, such as magnetic field imaging devices and nuclear magnetic resonance (NMR) spectrometers. Virtually all of these instruments are in daily use on the campus.

Light Rail trains disturb Earth's magnetic field and thereby produce electromagnetic interference in two ways:

1) Electric currents generate magnetic fields. Light Rail trains use large currents that change in strength and location as the train accelerates or moves past a location. This results in large fluctuations in the magnetic field of Earth as the train passes nearby. This "propulsion" field can be partially mitigated by decreasing the current or decreasing the distance between the current feed and return lines via a modified catenary system design. It decreases with distance from the source.

2) The movement of a large mass of ferromagnetic material, i.e., steel, in the Light Rail vehicles, perturbs the magnetic field produced by Earth. The size of this 'perturbation' field depends on the amount of mass, how susceptible it is to being magnetized, and distance. This effect can be mitigated by using non-conducting materials for train cars. Like the propulsion field, the perturbation field decreases with distance from the source.

A common unit of measure for EMI is a milliGauss (mG). Modern electron beam microscopes and nuclear magnetic resonance instruments, according to manufacturer's specifications, are adversely affected by EMI above 0.1 mG. The sensitivity of future instruments will very likely

increase and will certainly not decrease. Currently, ambient magnetic field fluctuations average about 0.15 mG at existing and planned research sites on the campus.

Based on EMI from Light Rail systems similar to the train configuration described in the AA/DEIS, University consultants have estimated that operation of the Light Rail Purple Line could result in EMI exceeding 0.2 mG as far away as 660 feet (200 m) from the tracks.

A map of the campus in Figure 1 shows the potential total EMI impact including a ¼ mile wide research dead zone for modern electron beam instrument operation. This zone includes major science research buildings (H.J. Patterson Hall, Microbiology, Physics, Bioscience Research Building, Biology-Psychology, Plant Sciences, and Geology along the Campus Drive alignment, and Marie Mount Hall on the Preinkert alignment). It also shows potential building sites in the Facilities Master Plan that will be negatively impacted unless the impacts are mitigated.

Vibrations

Vibrations traveling through the soil and structures interfere with the operation of a large number of commonly used instruments including electron beam instrumentation, atomic force microscopes, scanning tunneling microscopes, electron-beam lithography systems, laser interferometers and gravity gradiometers.

The U.S. National Institute of Standards and Technology (NIST) and the Institute of Environmental Science and Technology (IEST) have determined and specified the "quiet vibration environment" required for successful use of such sensitive instruments. Together they describe the acceptable tolerances to vibration: the NIST-A standard and the IEST VC-G standard have been commonly used for high end research. These standards are used in industry and academia today to ensure that conditions are acceptable for operating sensitive research instrumentation. The demands of future standards are likely to increase as instruments become more sensitive and as fields such as quantum computations, biotechnology and nanotechnology continue to develop. Today, most university research buildings meet or are comparable to the NIST-A criterion. Where there are deviations from this standard, the vibration problems result primarily from internal mechanical equipment, which can be replaced, isolated or moved as the need arises. In the absence of these local sources, the campus environment would be comparable to NIST-A at low frequencies and VC-G at higher frequencies.

Light Rail trains produce time-varying forces on their rails that generate vibration in the soil. Ground vibrations will propagate to campus buildings, producing an unsatisfactory platform for sensitive instruments. The amount of force exerted by a train on the soil is a product of many factors, including the train's weight, speed, wheels, suspension system as well as the vibration isolation and condition of the track. Maintenance of the Light Rail cars, tracks and system are also critical to achieving a sufficiently quiet vibration environment over the long term. Although MTA has not specified the design or manufacture of the trains it intends to run, data from other Light Rail systems and the Federal Transit Authority's *Transit Noise and Vibration Impact Assessment* allow a reasonable estimate of the vibration produced by trains and track equipment of the general type depicted in the AA/DEIS. The distance the light rail system will produce an

impact can then be estimated from recent studies of soil conditions and conductivity on campus.

A campus map showing the zone where Light Rail vibrations are likely to be in excess of the NIST-A standard is shown in Figure 2, and the zone where Light Rail vibrations will be in excess of the VC-G standard is shown in Figure 3. To draw this map the assumption was made that the Purple Line train will be 160 feet long and travel at 15 mph, as specified by the MTA, and that no mitigation is in place. The size of these dead zones will expand because of increasing vibrations as natural wear and tear to train wheels, rails, and roadbed occurs, and as maintenance is deferred. Also, the actual train selected could result in a higher train forcing function, which in turn would result in an expanded dead zone. Vibration violating NIST-A and VC-G will make current research buildings unsuitable for highly sensitive work. (Current buildings affected along the Campus Drive alignment include H.J. Patterson, Microbiology, Bioscience Research Building, Biology-Psychology, Plant Sciences, Physics, and Geology.) Locating future research buildings within the dead zone would be prohibited.

Acoustical Noise

For the most part, airborne noise is a human annoyance issue. However, some noise-sensitive research is currently conducted at the University. Unlike EMI and ground vibration, substantial engineering and research efforts have been dedicated to quantifying and evaluating the impact of noise on human activities. The University agrees that the FTA guidelines such as those described in the AA/DEIS provide a good starting point. However, the document does not make clear what FTA Land Use Category was used for the University. Much of the campus is dedicated to Category 3 uses, i.e., institutional land uses with primarily daytime and evening use. However, significant portions could be considered Category 2 uses, i.e., residential dormitories, and Category I uses, the Mall and other outdoor areas. In addition, noise sensitive research is conducted on the campus.

Mitigation Plan and Standards

MTA has charted two Purple Line alignments through the University: the Campus Drive route and the Preinkert Drive route. Unless MTA mitigates EMI and vibration *at their sources*, Light Rail traffic will cripple the University's research capabilities. The AA/DEIS, must develop and incorporate a mitigation plan at the sources (train/track system) that meets sensitive equipment standard for both (i) design and (ii) operation of the system through the campus. To prevent unnecessary disruption of ongoing and future campus research, the University needs to review and comment on the mitigation in the design and operation plans before their adoption and it also wishes sufficient time for its experts to review and comment on the plans.

Taking into consideration the location of dedicated research facilities, present and planned, and the nature of work conducted there, a committee of University research faculty has concluded that to preserve the University's research potential now and into the future, the following limits, *which conform to average current background conditions*, cannot be exceeded.. These limits must be met by mitigation and operation at the source. The different setbacks for the two alignments reflect differences in the distances from the alignments of current or planned

University buildings in which research dependent on sensitive instrumentation takes place.

Alignment	Maximum Allowable EMI	Maximum Allowable Vibration
Preinkert Drive	**0.15 mG at 300' from track**	**NIST-A at 300' from track**
Campus Drive	**0.15 mG at 100' from track**	**NIST-A at 100' from track**

The Purple Line could also affect research in the University's Research Park currently being completed east of Route 1. We have not studied the soils there to permit estimates of vibration propagation. We would accept Preinkert Drive standards for EMI and vibration at the Research Park, as they will allow us to develop the Park in accordance with the research requirement of our Federal and industrial tenants. The DEIS should include a mitigation plan for University review and comment for this section of the Purple line.

In addition to the EMI and vibration limits, acoustical noise must be addressed by a plan to meet FTA guidelines for Category 2 and Category 1 areas where appropriate and to address noise sensitive research. The University will work with the MTA to define these areas.

Preinkert Drive Alignment

The University believes technology exists capable of mitigating EMI and vibrations along the Preinkert Drive alignment to within the NIST-A and VC-G standards and the manufacturers' specifications for sensitive instruments required by our research program and faculty. The location and use of existing and planned facilities on the Preinkert route and the differences in soil permit a 300 foot zone to meet these standards. However, the University does not believe technology exists to mitigate EMI and vibrations along the Campus Drive alignment to the standards required by our research programs and faculty because the proximity of current science buildings and future building sites and soil conductivity allow only 100 feet to meet the standards.

The University believes the Preinkert alignment is better suited to the long-term orderly development of the campus. This alignment is consistent with and fulfills the University's Master Plan. The Preinkert alignment would introduce a new, dedicated transportation route for commuter lines, including Metro buses and University shuttle buses, near the edge of the campus. The Master Plan goal of closing Campus Drive to through traffic could be fulfilled. Not only would this alignment enhance a quiet research environment, it would also create the pedestrian friendly central core of campus envisioned by the Master Plan.

As proposed, the Preinkert Drive alignment traverses the campus above ground. The high pedestrian flow at known points of the route suggests that the portion of track between the Chapel on Chapel Drive and Morrill Hall near Preinkert Drive be run underground. This would have the additional significant benefit of eliminating airborne noise impact along the underground segment. MTA has considered an underground alignment for a segment of Campus Drive. The University requests MTA to consider a similar underground alternative for the

Preinkert Drive alignment through this short section of its route across campus.

Construction and Operating Agreements

The choice of an alignment and the development of an approved mitigation plan do not end the University's concern about the impact of the Purple Line. The University has asked the Regents to ensure that the MTA enter into both a construction agreement and an operating agreement with the University before the Regents grant access to the MTA or any others to construct a regional transportation system on University land. Construction must be managed to ensure the University can continue its educational and research activities unhindered, and an operating agreement sets up the long-term conditions for the operation of the Purple Line across campus, such as maximum speed, pedestrian right of way, adherence to campus traffic control, access to the alignment during emergencies and major campus events, and a plan to monitor both EMI and vibrations to ensure conformance with the mitigation plan and university standards.

Summary of Key Requirements

The National Institute of Standards and Technology (NIST) moved to Gaithersburg in part because it could no longer accomplish its research mission in the high traffic environment of Washington, DC. The University cannot move. Therefore, the Purple Line planning must acknowledge and accept the protection of the University's research environment now and into the future as an absolute requirement of the construction and operation of the cross-county transit system.

Specifically, fulfilling the following requirements for the Purple Line are mandatory:

1) The Environmental Impact Statement must incorporate a plan that mitigates the EMI, ground vibration, and airborne noise *at their sources* to the levels specified in this document for the selected alignment through campus.

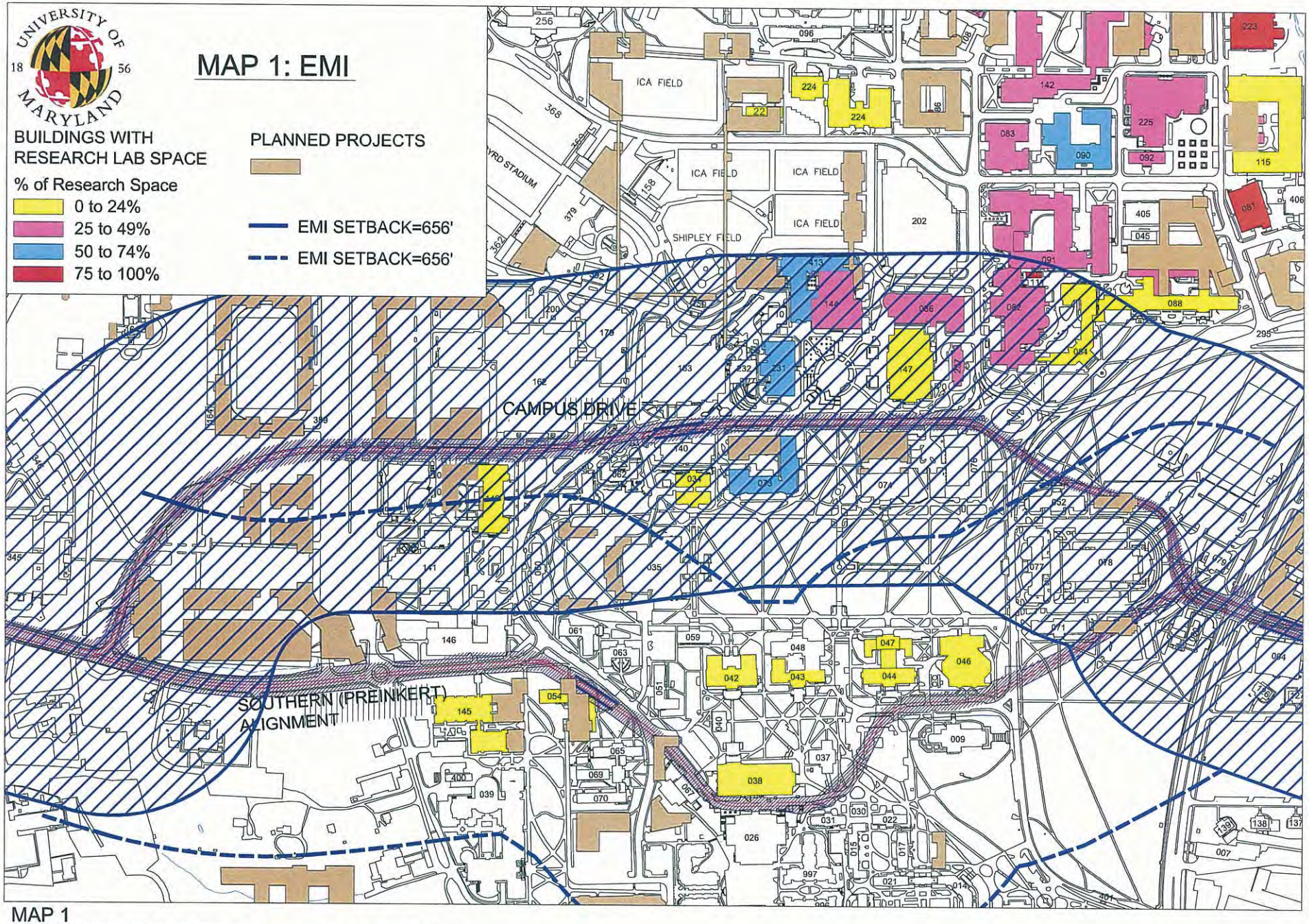
2) The Environmental Impact Statement must incorporate a plan that mitigates the EMI and ground vibration *at their sources* at the Research Park at the levels specified by the faculty for the Preinkert alignment.

3) The University demands the opportunity to review and comment on the complete EMI, vibration, and airborne noise mitigation plans for the campus and the Research Park alignments. Sufficient time must be allocated for this review to allow comment by consultants.

4) Before the USM Regents authorize the construction of a regional transportation system on University land by the MTA or any others, the University must approve both the construction plans and the agreements for operations now and into the future that will maintain an environment suitable for the research programs and campus environment.

5) The University recommends the MTA consider adding an underground alternative

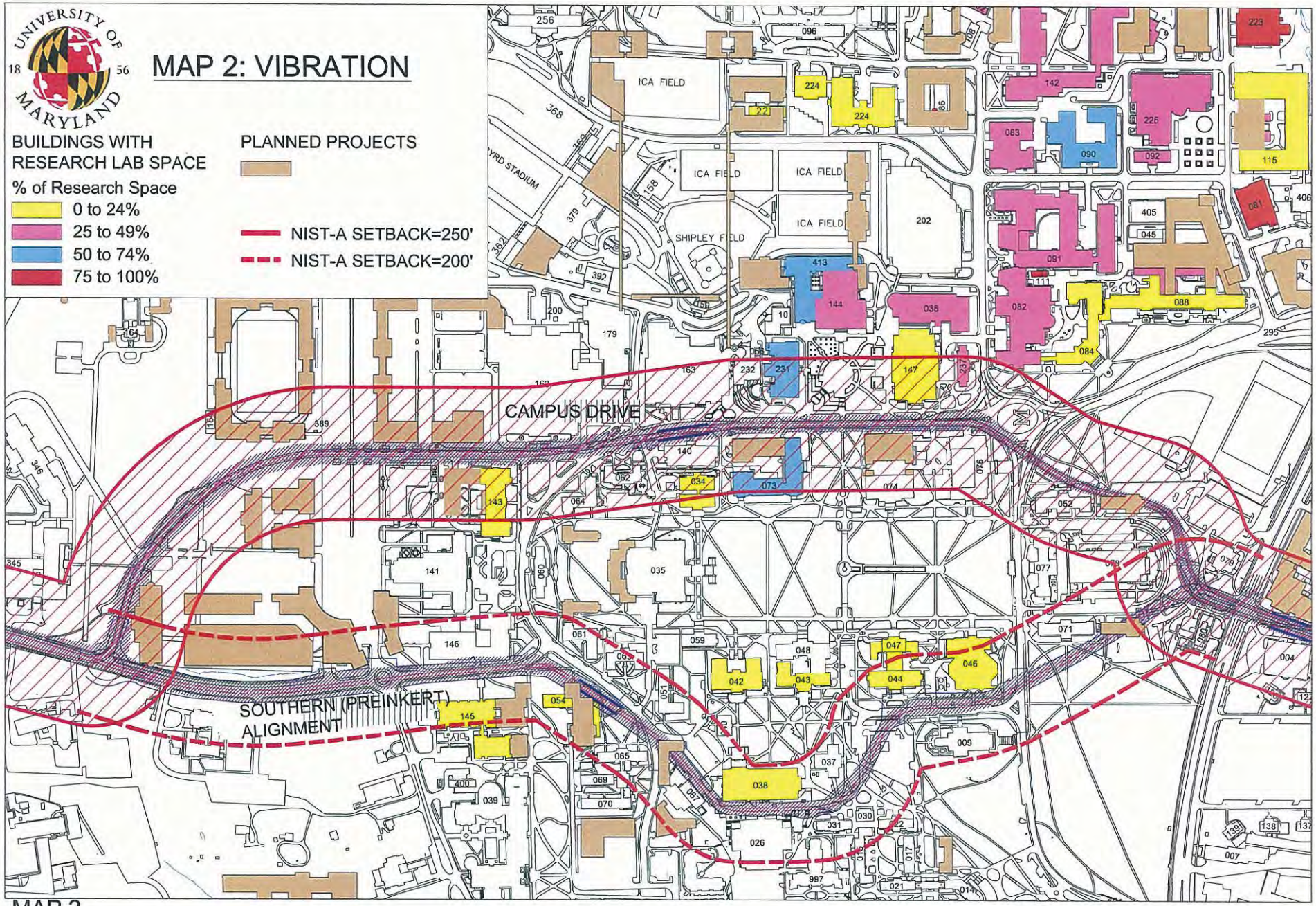
section to the Preinkert alignment as they have done for the Campus Drive alignment to reduce the Purple Line's environmental disturbance and to decrease travel time across a campus dominated by pedestrian traffic.



MAP 1
SETBACKS REQUIRED TO CONFORM WITH THE REQUIREMENTS OF MODERN ELECTRON MICROSCOPES
DATE:11-02-08
SOURCE OF DATA: JOHN BRANDON AND ASSOCIATES

0 500
Scale : 1" = 500'

K:\UmdFac\Planning\Purple Line\Prinkert_Campus Drive options combined(D).dwg -- MAP 1 8x11, Last Update : 12/ 12/08 - 1:28pm, Opened: 12/16/08 - 9:52am



MAP 2

SETBACKS REQUIRED TO MEET NIST-A CRITERIA FOR VIBRATION

DATE:11-02-08

SOURCE OF DATA: JOHN BRANDON AND ASSOCIATES

NOTE: SETBACK CONTROLLED BY PERFORMANCE AT 10 Hz. NIST-A SETBACK EQUAL TO VC-F SETBACK.

0 500

Scale : 1" = 500'

K:\UmdFac\Planning\Purple Line\Pfinkert_Campus Drive options combined(D).dwg -- MAP 2 8x11, Last Update : 12/ 12/08 - 1:28pm, Opened: 12/16/08 - 9:55am

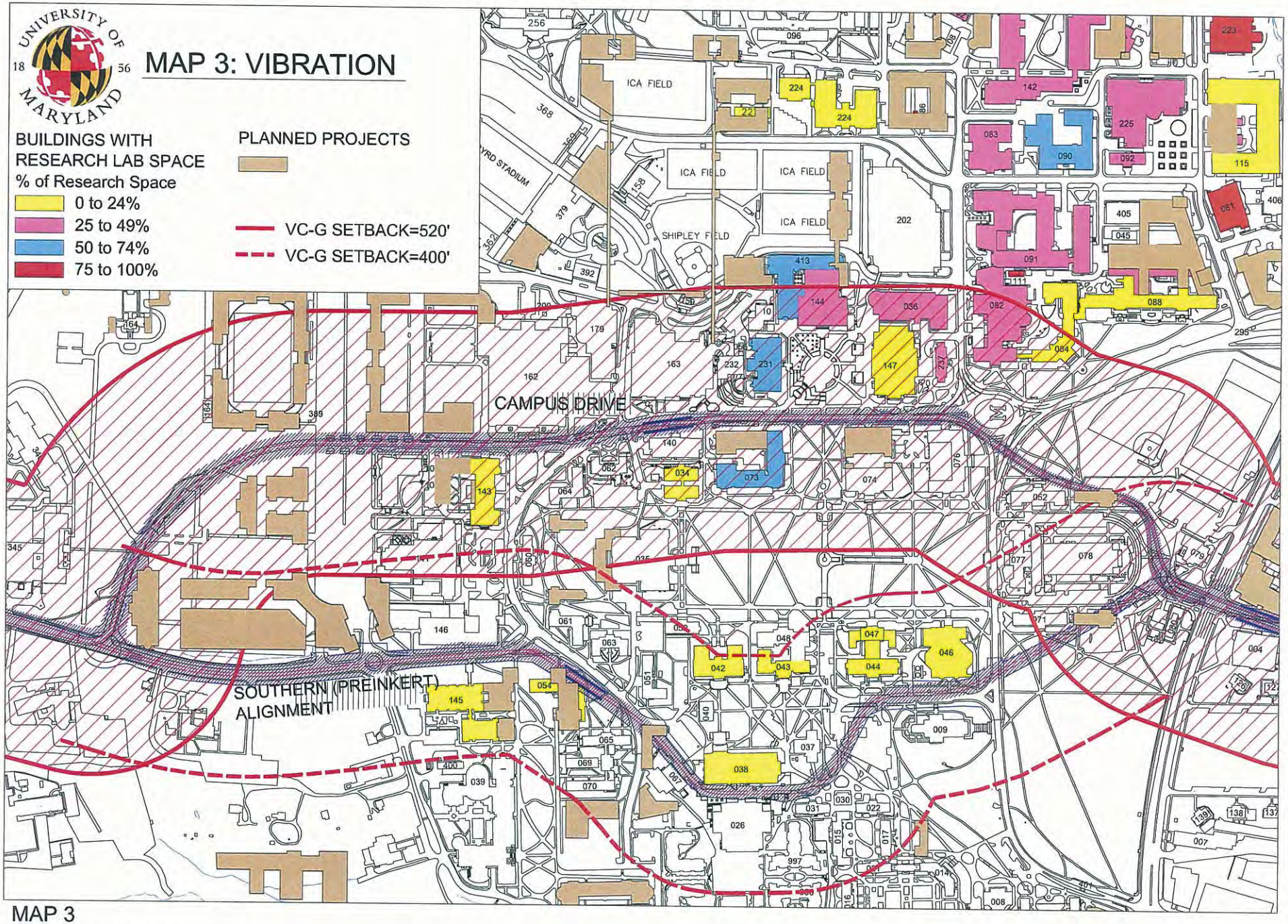
MAP 3: VIBRATION

BUILDINGS WITH RESEARCH LAB SPACE
% of Research Space

- 0 to 24%
- 25 to 49%
- 50 to 74%
- 75 to 100%

PLANNED PROJECTS

- VC-G SETBACK=520'
- VC-G SETBACK=400'



MAP 3
SETBACKS REQUIRED TO MEET VC-G CRITERIA FOR VIBRATION
DATE:11-02-08
SOURCE OF DATA: JOHN BRANDON AND ASSOCIATES

0 500
Scale : 1" = 500'

K:\UmdFac\Planning\Purple Line\Prinkert_Campus Drive options combined(D).dwg – MAP 3 8x11, Last Update : 12/ 12/08 - 1:28pm, Opened: 12/16/08 - 9:57am

MAP 4: OVERVIEW

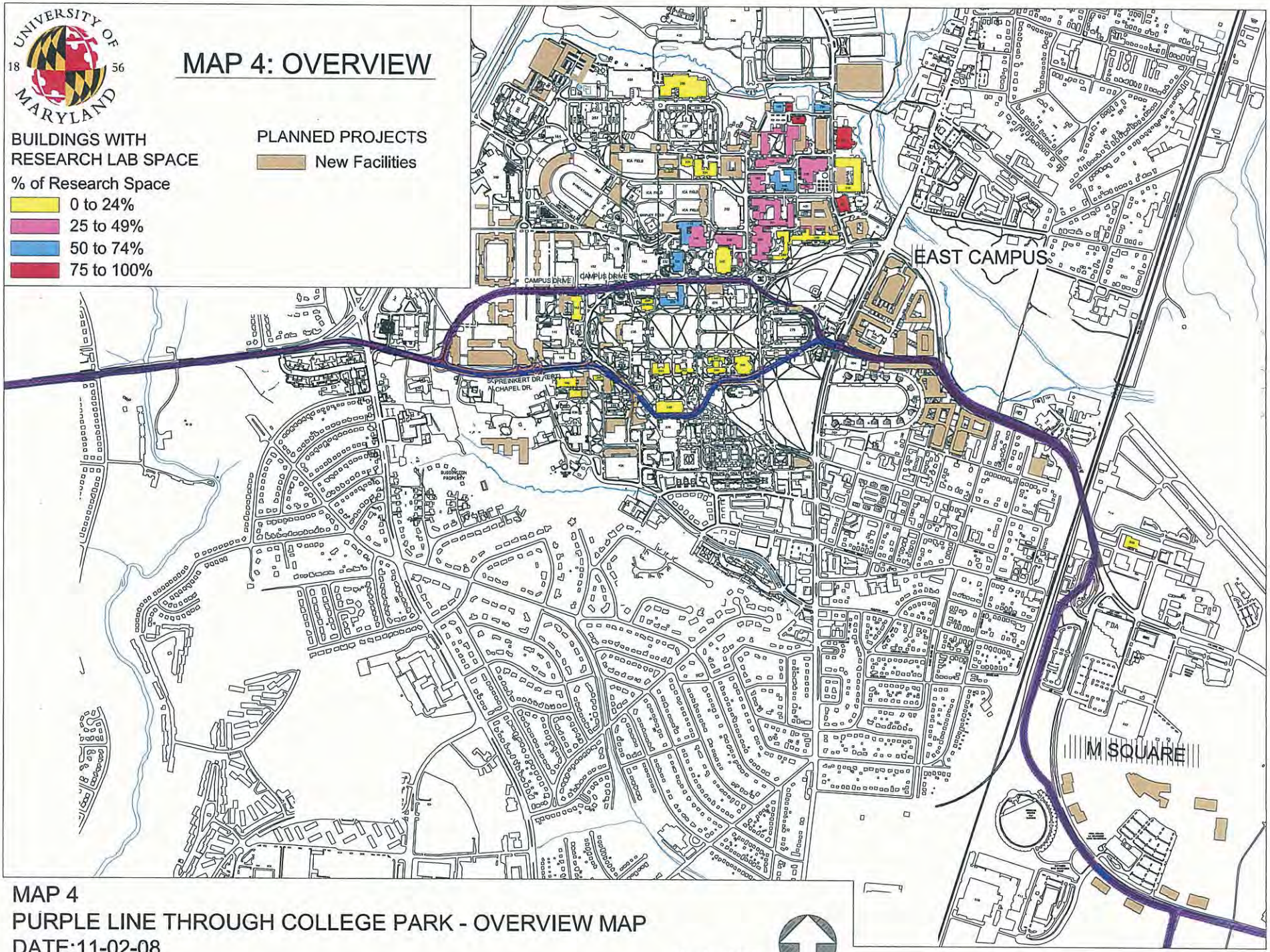
BUILDINGS WITH RESEARCH LAB SPACE

% of Research Space

- 0 to 24%
- 25 to 49%
- 50 to 74%
- 75 to 100%

PLANNED PROJECTS

- New Facilities



MAP 4

PURPLE LINE THROUGH COLLEGE PARK - OVERVIEW MAP

DATE:11-02-08

Scale : NTS

K:\UmdFac\Planning\Purple Line\Prinkert_Campus Drive options combined(D).dwg -- MAP 4 8x11, Last Update : 12/ 12/08 - 1:28pm, Opened: 12/16/08 - 9:58am

Executive Summary

The University of Maryland at College Park (UMD) is a major public research university, with enrollment of over 36,000 students. The Maryland Transit Administration (MTA) has been working on a proposed new transit line (the Purple Line) to offer better transportation options in Montgomery and Prince George's Counties. According to the MTA website, "[t]he Purple Line is a proposed 16-mile rapid transit line extending from Bethesda in Montgomery County to New Carrollton in Prince George's County." As we understand it, the Purple Line would be an electrified light surface rail system.

The proposed alignment for the Purple Line would pass through the UMD campus. Like any rail system, the Purple Line would introduce ground vibration, acoustical noise, and electromagnetic pollutants to the environment. We were asked to consult the University on matters regarding vibration and noise impact to research and other potentially-sensitive activities on campus.

The first part of this effort involves characterizing the current ambient vibration levels in buildings which lie close to two alternate alignment options. We also monitored environmental noise at four locations (two locations at each proposed alignment). This preliminary report documents our efforts towards this goal.

The ambient data presented in this report indicate that the University enjoys an exceptionally quiet environment. Overall, the campus vibration environment is comparable to other high end research institutions and universities. Data from the Parking Lots and from newer buildings (such as IPST) illustrate the possibilities. The environment at most buildings meets or is comparable with the NIST-A criterion, a special criterion designed for a facility at the National Institutes of Standards and Technology. In the absence of poorly-isolated local sources (mainly mechanical equipment inside the buildings), the performance of many buildings would be comparable to the most stringent criteria used in academia and industry (NIST-A at low frequencies, and VC-G at higher frequencies).

Between the two alignments, the Campus Drive Alignment has more potentially-vibration-sensitive buildings. Along the Preinkert Drive Alignment, only Lefrak Hall and Marie Mount Hall have been identified as vibration-sensitive. Vibration levels at Lefrak generally fall in the middle of the range of ambient levels shown in Figure 2. Vibration levels at Marie Mount Hall tend toward the high end of that range.

From an acoustical noise perspective, the preliminary data from the four monitoring locations are typical of a sub-urban campus environment. The monitoring locations along Campus Drive show greater variability with time-of-day; the variability implies that vehicular traffic noise during daytime hours dominates the local noise levels. The lower noise levels near the Shoemaker Building illustrate how the relative absence of vehicular traffic noise at this location decreases the time-of-day noise variability and overall noise levels. We expect that a more comprehensive acoustical survey would reveal that noise levels along the Campus Drive Alignment are typically higher than those along the Preinkert Drive Alignment.

The ambient data are intended to form the basis for UMD to arrive at the decision of how to accommodate the light rail system within its campus. The ideal alignment would be the one that would minimize the impact from vibration, noise, an EMI simultaneously.

Table of Contents

1. Background

The University of Maryland at College Park (UMD) is a major public research university, with enrollment of over 36,000 students. It is the largest university in Maryland and the Washington Metropolitan Area. Many members of the faculty receive funding and institutional support from government agencies such as the National Institutes of Health (NIH), the National Aeronautics and Space Administration (NASA) and the Department of Homeland Security (DHS). In addition, significant research relationships exist between faculty members and organizations such as the National Institutes of Standards and Technology (NIST).

The Maryland Transit Administration (MTA) has been working on a proposed new transit line (the Purple Line) to offer better transportation options in Montgomery and Prince George's Counties. According to the MTA website, "[t]he Purple Line is a proposed 16-mile rapid transit line extending from Bethesda in Montgomery County to New Carrollton in Prince George's County. It will provide a direct connection to the Metrorail Red, Green and Orange Lines; at Bethesda, Silver Spring, College Park, and New Carrollton." As we understand it, the Purple Line would be an electrified light surface rail system.

The proposed alignment for the Purple Line would pass through the UMD campus. Like any rail system, the Purple Line would introduce ground vibration, acoustical noise, and electromagnetic pollutants to the environment. We were asked to consult the University on matters regarding vibration and noise impact to research and other potentially-sensitive activities on campus. The electromagnetic issue is being addressed by others.

The first part of this effort involves the characterization of the current ambient vibration within each building. This preliminary report documents our efforts towards this goal. We focused on buildings identified as likely to house sensitive activities near the two alternative alignments.

2. Ambient Characterization Methodology

2.1 Overview

The University has asked us to characterize the current ambient condition in order to have a baseline against which to understand the impact of the proposed light rail system. This approach is justified on the basis of an "environmental stewardship" argument. The environment currently enjoyed by the UMD community is seen by the University as a natural resource that must be preserved.

2.2 Vibration Measurement Technique

We visited campus in July 2008 to collect ambient vibration data at UMD. The intent was to characterize the existing condition at the buildings that are located near the two alternate alignments. We consider that the entire building at this foundation level (with the exception of any mechanical spaces or their immediate adjacencies) should be usable for high end vibration-sensitive research.

Data were collected at the foundation of each building included in the survey. These foundation-level data are the most relevant to this study, since the vibration environment of upper-level suspended floors is dominated by local sources such as occupants moving about the building or mechanical equipment operating nearby. Only in limited cases of special floor structures (deep structures such as waffle floors or especially thick slabs) would a suspended floor behave similarly to the ground floor. Even for these special cases, we characterized the ground floor since the vibration

environment at the ground may be thought of as a base excitation input to the suspended floor above.

We collected data at an adequate number of locations to characterize each building environment. For especially large buildings or for buildings configured with different functional areas, we have broken the building into sub-components from the perspective of expressing the ambient condition. The measurement locations were chosen quasi-randomly in that there was no special motivation to choose any particular location; rather, wide coverage of the building footprint was desired. We avoided locations that are obviously compromised (such as immediately adjacent to a major mechanical room) and not representative of the building as a whole.

In many cases, we did not have access to laboratory spaces themselves; we collected data in the corridors adjacent to the potentially sensitive spaces. In general, the vibration environment in the corridor is expected to adequately represent the vibration environment only a few feet away inside the adjacent laboratories.[1] The data from the measurement locations within each building were typically collected within a span of an hour or less. In some cases, data collection was extended due to special experiments.[2]

Since the vibration environment at the foundation tends to be characterized by the effects of multiple distant, stationary and more or less continuous sources, we believe that these data provide a reasonable picture of the vibration environment of the buildings.

We attempted to collect data under what appear to be "normal" conditions. This means that we collected data during normal business hours, with people and buildings operating normally. Conversely, we did not measure during the (typically quieter) overnight hours, since we assume that the research environment should generally be usable during normal business hours, and since it is expected that the light rail system does not operate overnight.

In addition, we take special care to avoid contaminating the ambient data set with measurements taken under extraordinary circumstances. For example, at buildings adjacent to construction sites, we do not collect data during construction activities, since these activities are assumed to be temporary.

In the case of UMD, we collected data during the summer session when student activity is generally lower than during fall or winter sessions. We do not believe that this had a significant effect on the vibration environment, since students contribute little to traffic around campus, and since foot traffic is irrelevant in the regime we are studying.

We have used this protocol to characterize large campus and campus-style environments in the past. This approach has been validated against longer-term monitoring efforts in multiple instances. Therefore, we are comfortable that this approach allows us to express the existing ambient condition with high confidence.

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[1] This is because (1) the data were collected on the same slab-on-grade (SOG) floors as the labs themselves; (2) the wavelengths in the frequency range of interest are many meters long; and (3) the environmental sources of interest are primarily distant and diffuse.

[2] As described later, we performed two long-term (15-minute) measurements to confirm our assumption that the linear averaged data converge quickly.

2.3 Acoustical Noise Measurement Technique

During our visit to perform ambient vibration measurements, we also conducted preliminary noise monitoring. This effort was not as comprehensive as the vibration survey effort; rather, this preliminary noise survey was intended to provide a general idea of noise levels on campus. Unlike vibration pollution, noise pollution is the subject of extensive regulatory, academic, and engineering interest. Techniques for noise monitoring are more widely known and have been extensively vetted; the technique used by us is a common one using industry standard noise monitors. We collected noise data over 1-hour periods and measured in terms of sound equivalent noise levels (L_{eq}) as well as L_n statistical noise levels. All data are overall sound levels using A-weighting; spectral data are available upon request.

3. Data Collection

3.1 Measurement System Parameters

We measured ambient vibration and noise using our standard testing suite:

Instrument	Make / Model	Identification
Signal Analyzer	Dactron Photon (4-ch.)	v1.4, S/N 4558652
Accelerometer	Wilcoxon 731A	S/N 1657
Noise Meter	Norsonic N-140	S/N 1403260
Microphone Preamplifier	Norsonic N-1209	S/N 12749
Microphone	Norsonic N-1225	S/N 96063
Noise Meter	Norsonic N-140	S/N 1402711
Microphone Preamplifier	Norsonic N-1209	S/N 12251
Microphone	Norsonic N-1225	S/N 79717
Field Noise Calibrator	B&K 4231	S/N 2292439

The Photon signal analyzer, used for the vibration measurements, was interfaced via USB to an IBM ThinkPad T43 laptop computer. Data were processed by Dactron RT Pro (v6.08) and formatted for presentation using Microsoft Excel v2003. During our tests, ambient data were collected in units of velocity with 90-frame linear averaging from DC to 125Hz using 400 lines of FFT resolution. The Hanning FFT windowing function was applied, with 90% frame overlap to insure capture of transient events.

These analyzer settings result in the capture and analysis of about 30-seconds of data. In two cases, we performed a special experiment to validate the seemingly-short data capture; in these cases, we allowed the analyzer to run for a full 15 minutes. A comparison of the short-term and long-term data is given in Appendix D.

The noise meters were programmed to collect 1-hour statistical data for a 24-hour period. Noise data for L_n statistics (L_3, etc.) were recorded using the "fast" detector setting in 1/3 octave bands. The detector setting does not apply for equivalent sound levels, L_{eq}. Data are reported as overall A-weighted sound levels as L_{eq} and L_3 (top 3%); L_5 (top 5%); and L_{10} (top 10%).

3.2 Measurement Locations

We collected data at 16 buildings and in two parking lots. The buildings are:

1. AV Williams (AVW)
2. Biosciences Research (BPS)
3. Biomolecular Sciences (BMS)
4. Computer and Space Science (CSS)
5. Chemical and Nuclear Engineering (CHE)
6. Chemistry (CHM)
7. Geology (GEO)
8. HJ Patterson (HJP)
9. IPST (IPT)
10. Kim Engineering (KIM)
11. Lefrak Hall (LEF)
12. Marie Mount Hall (MMH)
13. Martin Engineering (EGL)
14. Microbiology (MCB)
15. Physics (PHY)
16. Plant Sciences (PLS)

In addition, we took data in Parking Lots 1B and 1D. The buildings are highlighted in Figure 1, with the proposed alignment options indicated.

Noise data were gathered at four outdoor locations:

1. Memorial Chapel, in the landscaping at the northeast corner of the building
2. Shoemaker Building, in the hedge at the northeast corner of the building
3. Symons Hall, in the shrubbery opposite the sidewalk at the entrance
4. Stamp Student Union, in the landscaping on the south face of the building

In all instances, the monitors were hidden in shrubs/bushes at least 5 feet from any surface (building or ground). The noise measurement locations are indicated as solid green circles in Figure 1.

3.3 Site Conditions

We performed measurements during the week immediately prior to new-student move-in. However, traffic on campus and city roads appeared to be normal. Bus traffic and truck deliveries were commonly seen, and year-round occupants (staff, graduate students, etc.) were present. Our understanding is that students contribute little to traffic; in fact, it is possible that the lack of students allowed traffic (especially along Campus Drive) to flow *faster* and therefore have somewhat *higher* vibration and noise impact.

The weather was hot and humid during our visit, and a thunderstorm occurred one evening. Construction (including earthworks) was underway on the new Journalism Building. During data collection in the parking lots, the immediate aisles in which we worked were blocked; however, traffic was otherwise normal in the area. Aside from the construction activities, there was no indication of any special events or extraordinary circumstances. We believe that we successfully avoided data contamination from construction activities.

3.4 Data Presentation

Statistical analyses of the ambient vibration data were performed using Microsoft Excel v2003. From the statistical analyses, we obtained Minimum, Average, Average + σ, and Maximum spectra. In the figures plotting the results of our measurements, all four statistical measures are shown. The spectra are given in linear terms with units of RMS velocity (in micro-inches per second). In each figure, Part (a) shows the narrowband data; 1/3 octave band data are shown in Part (b) of each figure. The narrowband data are used in a diagnostic manner; they illustrate the vibration environment in fine detail. The 1/3 octave band data are the relevant metric for comparison to train-induced vibrations.

4. Ambient Vibration and Noise Summaries

Statistical summaries for each of the individual buildings are given in Appendix B. These summarize the raw data on which the building ambient levels are defined. For each building, the "ambient vibration condition" is defined as the average 1/3 octave band spectrum obtained from the individual measurements.[3] **The ambient measurement results are given in Table 1.** The measured data are summarized statistically in Figure 2. This figure plots the statistical data reduction based on the individual ambient levels for all 16 buildings.[4] Therefore, the plot in Figure 2 illustrates the range of ambient vibration levels seen across the 16 buildings included in this study.

This range of data is reproduced in Figure 3; overlaid is the spectrum obtained from Parking Lots 1B and 1D. Since the parking lot data are fundamentally different from the building data in that no local sources (ie, rotating mechanical systems) exist, we did not include these in the statistical summary shown in Figure 2.

The preliminary data collected at the four noise monitoring locations are plotted in Figure 4. The full data sets are available in Appendix C.

5. Online / Interview Survey

In parallel with the field study, we also conducted an online survey and personal interviews with stakeholders. This effort is intended to identify and understand the different kinds of sensitivities on campus. We received responses from about 70 people, with concerns about vibration, noise and EMI/MF ranging from high-end physics research to human-scale sensitivities.

The survey responses were condensed and formatted for review; where relevant, building vibration data and / or tool criteria were included. No noise data are currently included in these. Due to the volume of responses, these are transmitted separately from this report.

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[3] See the blue "Average" curve in Part (b) of each plot in Appendix B.

[4] Note that these statistics are based on the set of 16 building ambient spectra. This means that this is a statistical summary of *averaged* data. For example, the min-to-max range shown here is not the min-to-max range seen at any location; rather, it is the range of building ambients.

6. Observations

The ambient data presented in this report indicate that the University enjoys an exceptionally quiet environment. In some cases (such as the Geology Building), local vibration sources inside the buildings themselves contribute greatly to the vibration environment. As seen in Figure 3, vibration levels in Parking Lots 1B and 1D mimic the expected behavior of the true "environmental" contribution to the building vibration environments.[5] Overall, the campus vibration environment is comparable to other research institutions and universities. Data from the Parking Lots and from newer buildings (e.g. IPST) illustrate how quiet buildings could be with control of local sources.

As illustrated in Figure 2, the environment at most buildings meets or is comparable with the NIST-A criterion, a special criterion designed for a facility at the National Institutes of Standards and Technology. In the absence of poorly-isolated local sources (mainly mechanical equipment inside the buildings), the performance of many buildings would be comparable to the most stringent criteria used in academia and industry (NIST-A at low frequencies, and VC-G at higher frequencies).

Between the two alignments, the Campus Drive Alignment has more potentially-vibration-sensitive buildings. Along the Preinkert Drive Alignment, only Lefrak Hall and Marie Mount Hall have been identified as vibration-sensitive. Vibration levels at Lefrak generally fall in the middle of the range of ambient levels shown in Figure 2. Vibration levels at Marie Mount Hall tend toward the high end of that range.

From an acoustical noise perspective, the preliminary data from the four monitoring locations are typical of a sub-urban campus environment. The monitoring locations along Campus Drive show greater variability with time-of-day; the variability implies that vehicular traffic noise during daytime hours dominates. The lower noise levels near the Shoemaker Building illustrate how the relative absence of vehicular traffic noise at this location decreases the time-of-day noise variability and overall noise levels. A more comprehensive acoustical survey would probably reveal that noise levels along the Campus Drive Alignment are higher than those along the Preinkert Drive Alignment.

The ambient data are intended to form the basis for UMD to arrive at the decision of how to accommodate the light rail system within its campus. The ideal alignment would be the one that would minimize the impact from vibration, noise, an EMI simultaneously.

• • •

This concludes our report on the current ambient vibration and noise enjoyed by UMD. Please feel free to call if you have any questions. We may be reached in our offices by telephone at (+1) 415-693-0424 or via email at byron@va-consult.com.

Sincerely,

Byron Davis
Vibro-Acoustic Consultants

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[5] In Figure 3, note that the parking lot data fall in the middle of the range in the low-frequency regime, and lie at the low end of the range in the high-frequency regime. This is exactly the relationship that would be expected if, for the buildings, low-frequency performance were dominated by environmental sources while high-frequency performance was dominated by local sources.

Figure 1: University of Maryland / Purple Line – September 2008
Campus map, with buildings indicated for which vibration data were collected
Outdoor noise monitoring locations indicated by green circles

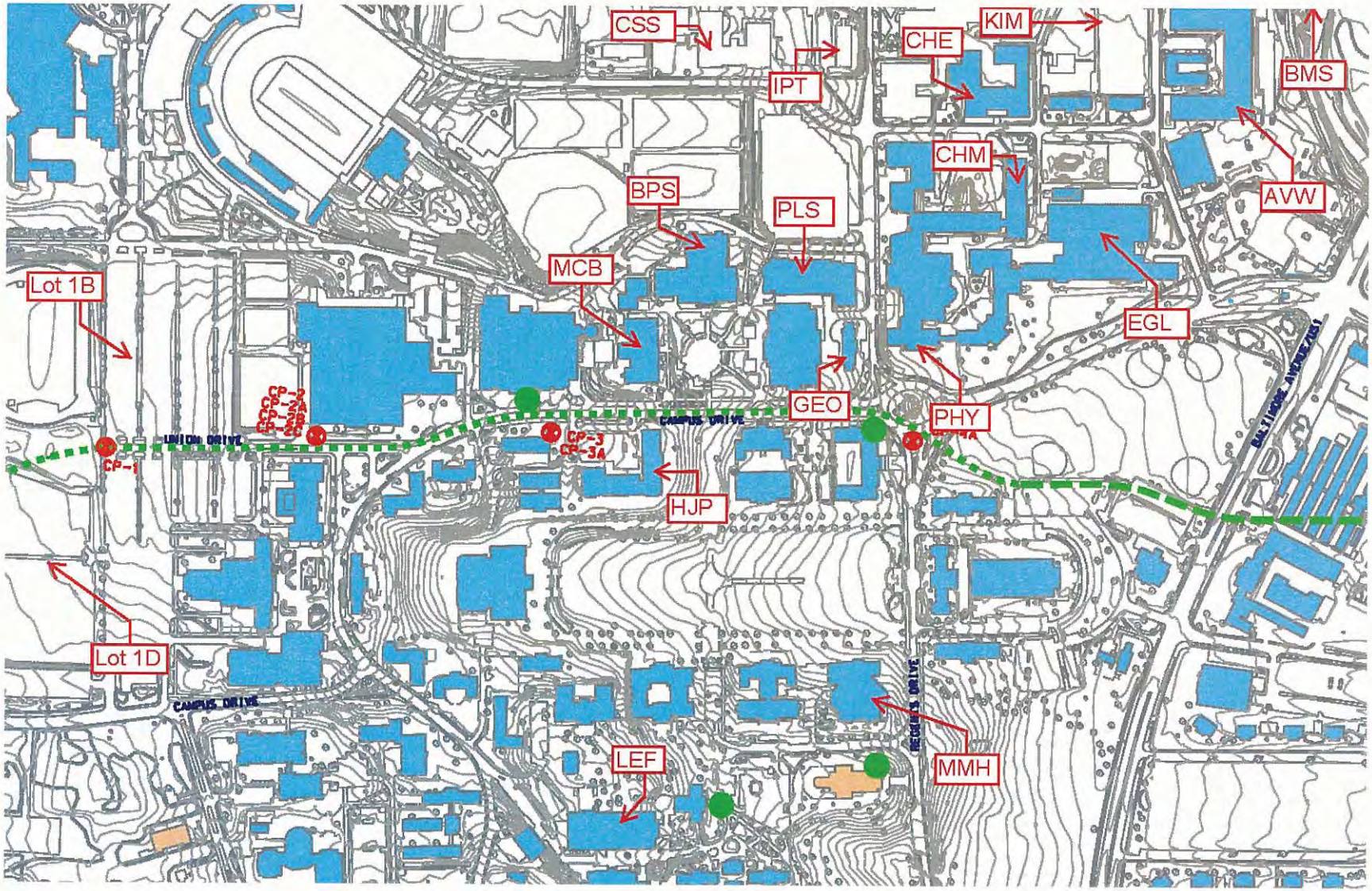


Table 1: University of Maryland / Purple Line – September 2008
Measured Vibration Levels at 16 Research-Oriented Buildings (July 2008)

	1/3 Octave Band Center Frequency [1]																				
Building	**1**	**1.3**	**1.6**	**2**	**2.5**	**3.2**	**4**	**5**	**6.3**	**8**	**10**	**12.5**	**16**	**20**	**25**	**32**	**40**	**50**	**63**	**80**	**100**
AV Williams (AVW)	7	4	3	3	3	4	8	18	55	47	44	43	52	29	16	18	10	6	31	7	8
BioSciences Research (BPS)	11	5	4	4	4	4	9	21	36	51	54	54	47	35	39	37	19	18	42	23	44
Biomolecular Sciences (BMS)	6	5	4	4	8	7	11	19	40	54	45	49	40	37	19	65	28	36	109	40	38
Computer & Space Science (CSS)	10	5	4	3	8	5	6	13	21	46	40	184	141	108	83	277	61	41	45	15	8
Chemical and Nuclear (CHE)	7	4	4	4	6	7	12	26	50	44	39	40	58	27	65	34	34	23	31	15	10
Chemistry (CHM)	8	5	5	5	11	7	13	29	37	47	47	73	42	218	140	94	43	24	30	16	10
Geology (GEO)	10	7	6	6	11	14	21	43	57	73	95	68	143	104	39	349	343	138	105	87	60
HJ Patterson (HJP)	7	5	5	5	10	13	23	52	46	75	75	56	42	26	38	64	30	26	37	9	6
IPST (IPT)	6	4	3	2	3	3	5	12	23	19	16	24	20	14	9	31	8	13	19	14	12
Kim Engineering (KIM)	8	5	4	4	8	7	12	17	36	43	49	51	59	56	36	44	22	17	43	15	12
Lefrak [2] (LEF)	8	6	5	5	8	11	22	35	26	38	44	84	112	87	35	78	29	25	21	18	17
Marie Mount [2] [3] (MMH)	13	11	10	9	15	17	22	33	48	80	80	65	113	88	121	164	89	54	55	50	57
Martin Engineering (EGL)	12	7	6	7	8	8	16	39	58	64	70	49	51	47	53	42	67	45	54	36	26
Microbiology (MCB)	8	4	4	4	6	9	20	34	46	110	129	105	69	91	69	189	45	45	75	28	19
Physics (PHY)	11	6	5	5	5	6	11	25	36	37	36	45	47	31	18	20	39	24	52	32	6
Plant Sciences (PLS)	12	6	4	4	3	4	7	27	42	40	47	45	96	78	27	42	17	17	76	13	10
Parking Lots 1B/1D [4] [5] (PRK)	18	11	7	5	6	6	12	20	27	26	27	22	16	10	7	7	10	7	5	4	4
Min Ambient, 16 Bldgs (MIN)	6	4	3	2	3	3	5	12	21	19	16	24	20	14	9	18	8	6	19	7	6
Max Ambient, 16 Bldgs (MAX)	13	11	10	9	15	17	23	52	58	110	129	184	143	218	140	349	343	138	109	87	60
Avg Ambient, 16 Bldgs (AVG)	9	6	5	5	7	8	14	28	41	54	57	65	71	67	50	97	55	35	52	26	22
Average + StDev Ambient (AST)	11	7	6	6	11	12	20	39	53	76	84	102	109	118	88	195	135	65	79	46	40

Notes: [1] Data expressed in RMS velocity in micro-inches/second within each 1/3 octave band; data from the vertical direction.
[2] Lefrak and Marie Mount along Preinkert Drive Alignment; all other buildings along Campus Drive Alignment.
[3] 17.2Hz tone snipped from data at Marie Mount Hall.
[4] No structures were present in the parking lots; however, environmental sources (nearby roads) still exist.
[5] The parking lot data were not used in developing the statistics at the bottom of the chart.

Figure 2: University of Maryland / Purple Line – September 2008
Statistical Summary of Building Ambient Vibration for 16 Research-Oriented Buildings Across Campus

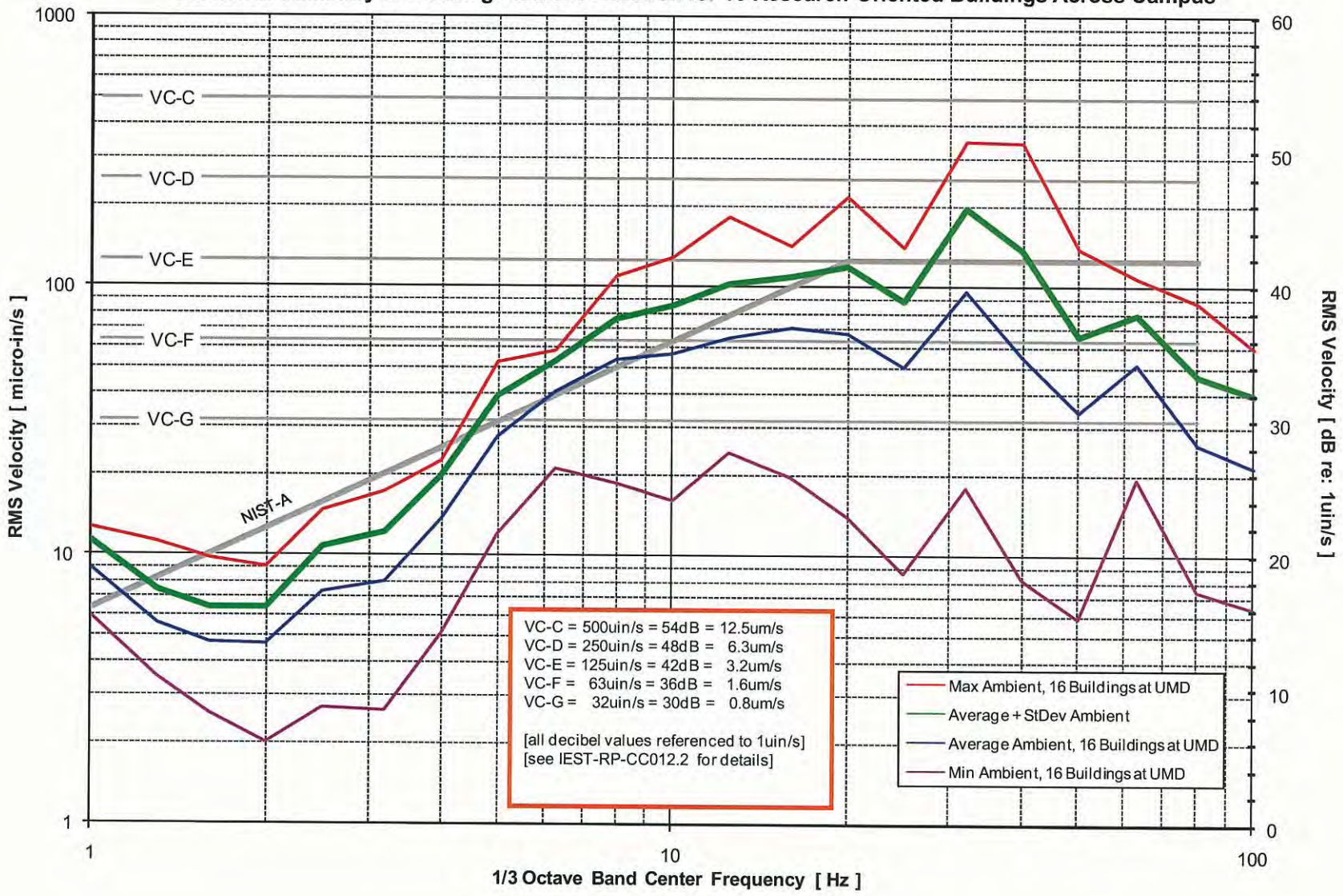


Figure 3: University of Maryland / Purple Line – September 2008
Comparison of Ambient Vibration: Parking Lots 1B, 1D vs. Range of 16 Research-Oriented Buildings Across Campus

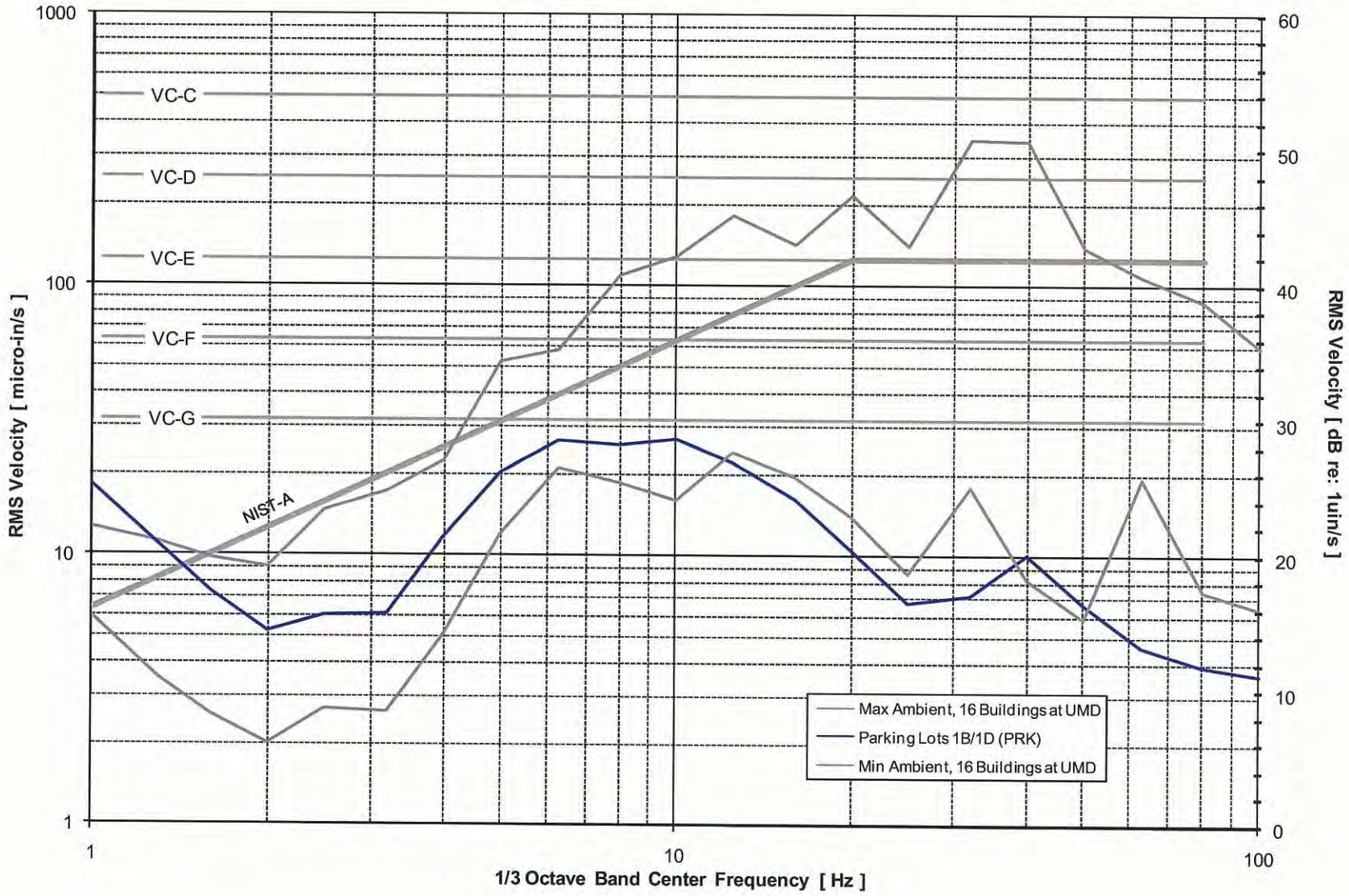
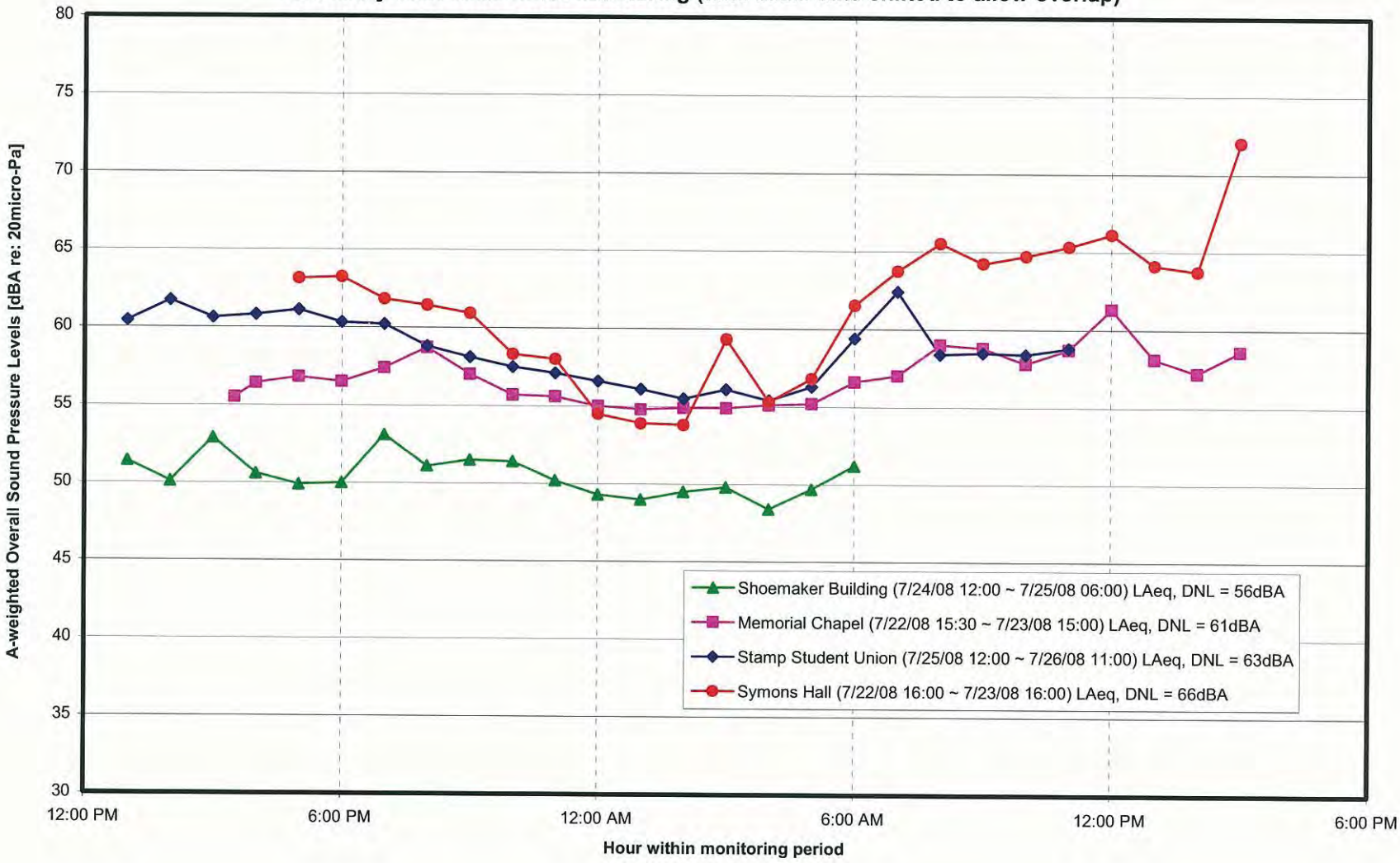


Figure 4: University of Maryland / Purple Line – September 2008
Summary of 24-Hour Noise Monitoring (time scale date-shifted to allow overlap)



Appendix A: Generic Design Criteria for Vibration-Sensitive Equipment and Processes

This appendix presents vibration criteria that have been used quite extensively for over two decades, particularly in the microelectronics industry. The criteria take the form of a set of one-third octave band velocity spectra, which are labeled vibration criterion curves VC-A through VC-G. These are shown in Figure A.1, together with the International Standards Organization (ISO) guidelines for the effects of vibration on people in buildings. The criteria apply to vibration as measured in the vertical and two horizontal directions. The application of these criteria as they apply to people and vibration-sensitive equipment is described in Table A.1. The main elements of the criteria follow:

1) The floor vibration is expressed in terms of its root-mean-square (RMS) velocity (as opposed to displacement or acceleration). It has been found in various studies that while different items of equipment (and people) may exhibit maximum sensitivity at different frequencies (corresponding to internal resonances), often these points of maximum sensitivity lie on a curve of constant velocity.

   Note: There is little validity in a criterion that attempts to define a vibration displacement limit based on a small fraction of the dimension being examined (in the case of metrology) or inscribed (in the case of lithography). The resonant responses of most systems are too complex for this simplistic approach.

2) The use of a proportional bandwidth (the bandwidth of the one-third octave is twenty-three percent of the band center frequency) as opposed to a fixed bandwidth is justified on the basis of a conservative view of the internal damping of typical equipment components. Experience shows that in most environments the vibration is dominated by broadband (random) energy rather than tonal (periodic) energy.

3) The fact that the criterion curves allow for greater vibration velocity for frequencies below 8 Hz reflects experience that this frequency range, in most instances, lies below the lowest resonance frequency. Relative motions between the components are, therefore, harder to excite and the sensitivity to vibration is reduced.

4) For a site to comply with a particular equipment category the measured one-third octave band velocity spectrum must lie below the appropriate criterion curve of Figure A.1.

These equipment criterion curves have been developed on the basis of data on individual items of equipment and from data obtained from measurements made in facilities before and after vibration-related problems were solved. The curves are generic in the sense that they are intended to apply to broadly defined classes of equipment and processes. **They are intended to apply to the more sensitive equipment within each category that is defined.**

The criteria assume that bench-mounted equipment will be supported on benches that are rigidly constructed and damped so that amplification due to resonances are limited to a small value. The criteria take into account the fact that certain types of equipment (such as SEMs) are supplied by the manufacturer with built-in vibration isolation.

It is important to note that these criteria are for guidance only. The "detail sizes" given in Table A.1 appear to represent experience at the time of writing. They reflect the fact that the quality of design and of built-in isolation in most equipment tends to improve as dimensional requirements become more stringent. In some instances the criteria may be overly conservative because of the high quality of built-in isolation. Thus, for instance, many steppers used in photolithography are, currently, relatively insensitive to vibration. In most instances it is recommended that the advice of equipment manufacturers or of a vibration consultant be sought in selecting a design standard.

Figure A.1: Generic Vibration Criterion (VC) Curves for vibration-sensitive equipment and processes. The ISO Guidelines for people in buildings are shown for reference.

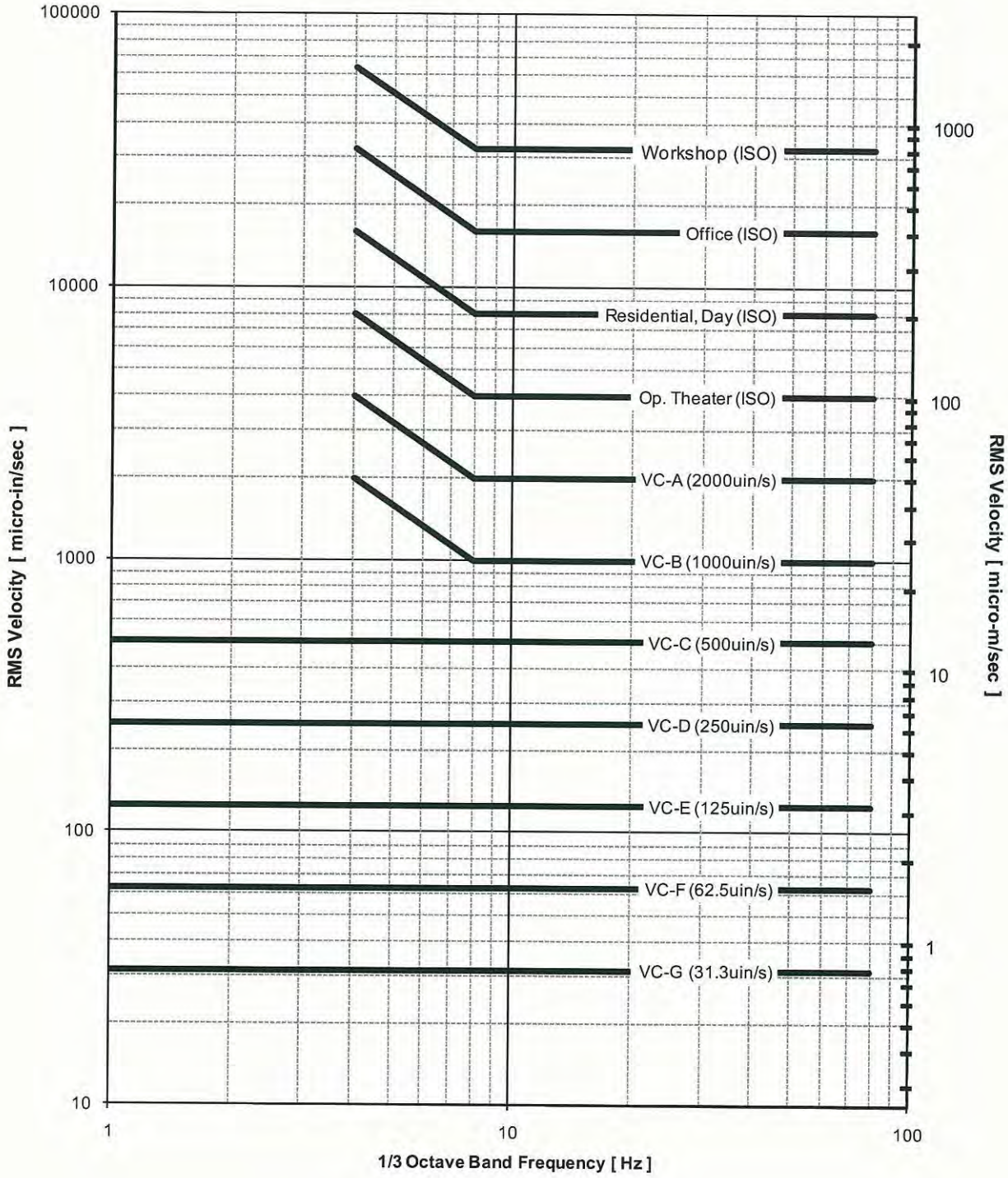


Figure A.2: VC Curves (US Customary Units), Plotted on a Nomograph Simultaneously Depicting Displacement, Velocity, and Acceleration

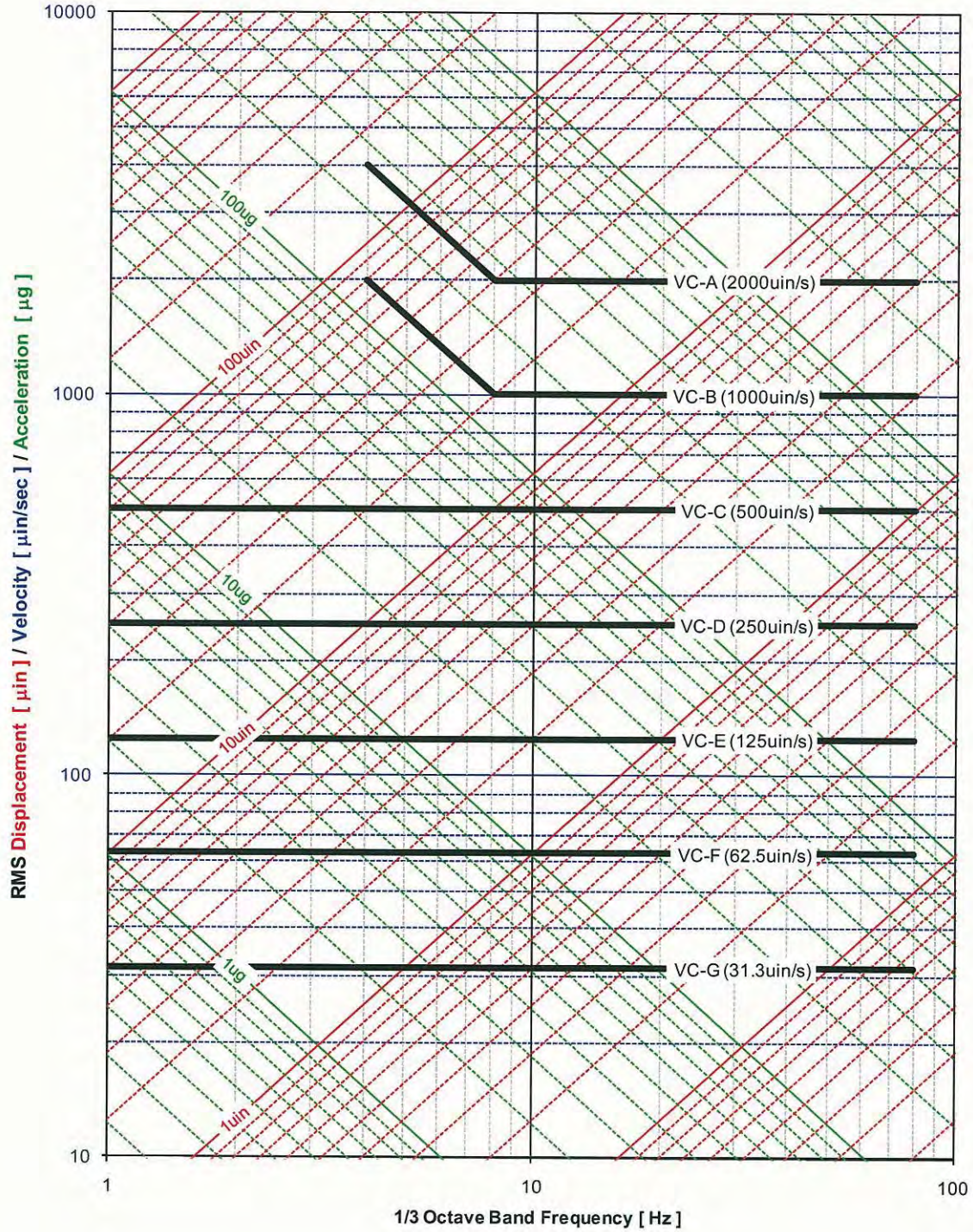


Table A.1: Application and interpretation of the generic vibration criterion (VC) curves (as shown in Figure A.1)

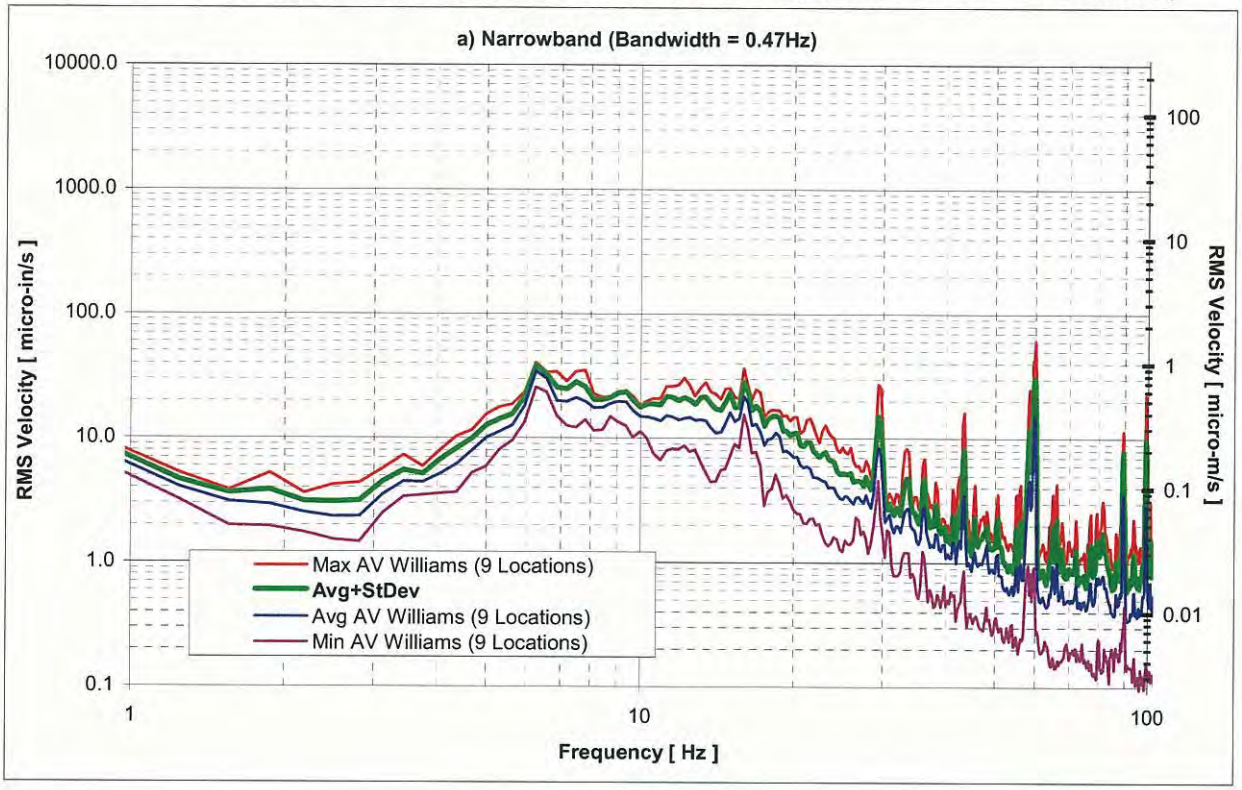
Criterion Curve (see Figure 1)	Amplitude (1) micro-in/s (micro-m/s)	Detail Size (2) microns	Description of Use
Workshop (ISO)	32000 (800)	N/A	Distinctly feelable vibration. Appropriate to workshops and nonsensitive areas.
Office (ISO)	16000 (400)	N/A	Feelable vibration. Appropriate for offices and nonsensitive areas.
Residential Day (ISO)	8000 (200)	75	Barely perceptible vibration. Appropriate for sleep areas. Usually adequate for computer equipment, probe test equipment, and microscopes less than 40x.
Op. Theatre (ISO)	4000 (100)	25	Vibration not perceptible Suitable for sensitive sleep areas. Suitable in most instances for microscopes to 100X and for other equipment of low sensitivity.
VC-A	2000 (50)	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	1000 (25)	3	Appropriate for inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C	500 (12.5)	1 - 3	Appropriate standard for optical microscopes to 1000x, lithography and inspection equipment (including moderately sensitive electron microscopes) to 1 μm detail size.
VC-D	250 (6.3)	0.1 - 0.3	Suitable in most instances for demanding equipment, including many electron microscopes (TEMs and SEMs) and E-Beam systems.
VC-E	125 (3.12)	<0.1	A challenging criterion to achieve. Assumed to be adequate for the most demanding of sensitive systems, including long path, laser-based, small target systems, electron-beam lithography systems working at nanometer scale, and other systems requiring extraordinary dynamic stability.
VC-F	62.5 (1.56)	N/A	Appropriate for extremely quiet research spaces; generally difficult to achieve in most instances, especially cleanrooms. Not recommended for use as a design criterion, only for characterization.
VC-G	31.3 (0.78)	N/A	Appropriate for extremely quiet research spaces; generally difficult to achieve in most instances, especially cleanrooms. Not recommended for use as a design criterion, only for characterization.

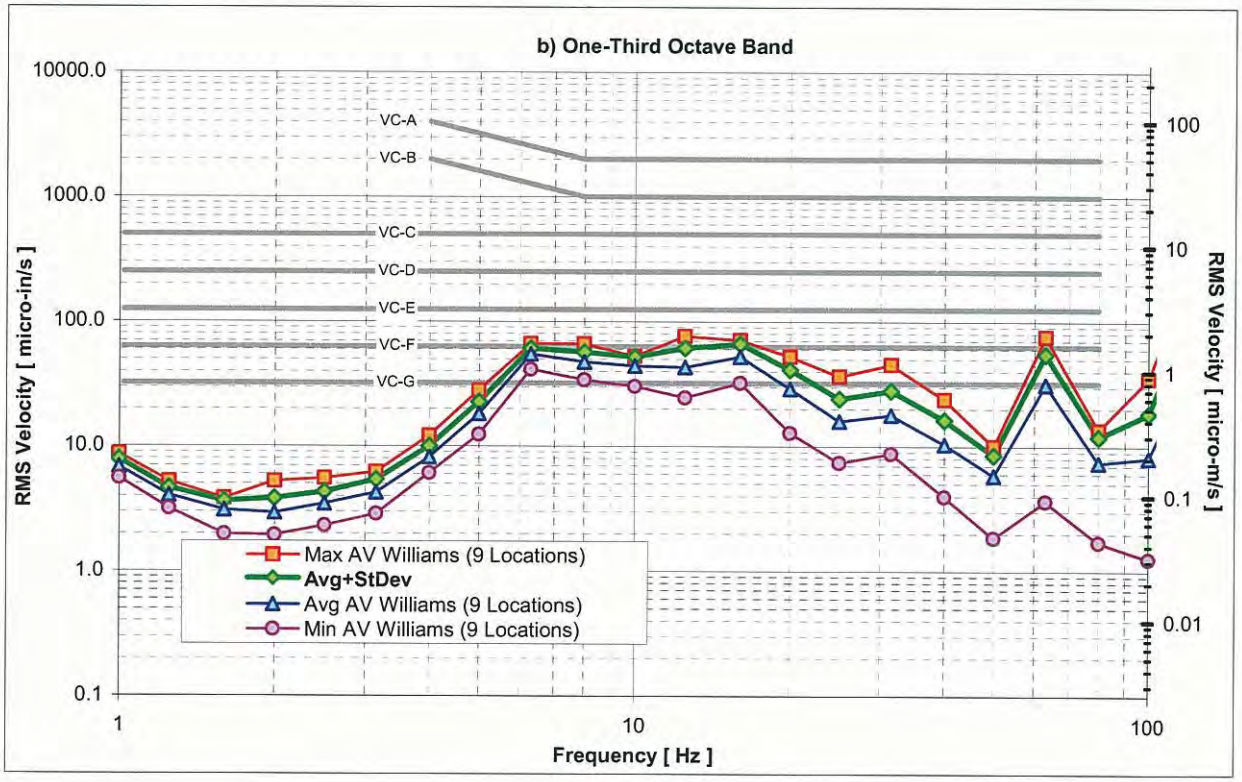
Notes:

(1) As measured in one-third octave bands of frequency over the frequency range 8 to 80 Hz (VC-A and VC-B) or 1 to 80 Hz (VC-C through VC-G)

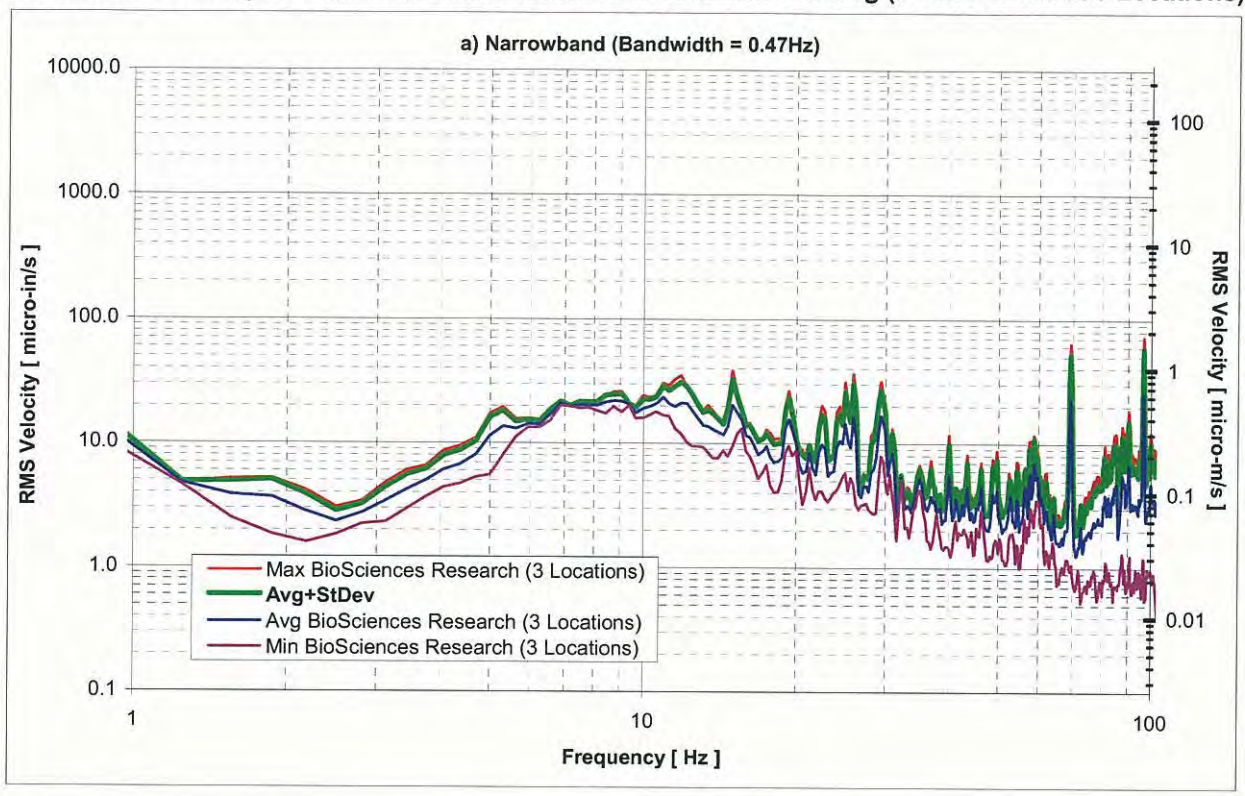
(2) The detail size refers to the line widths for microelectronics fabrication, particle (cell) size for medical and pharmaceutical research, etc. Detail size is not relevant to imaging associated with probe technologies, AFMs, and nanotechnology.

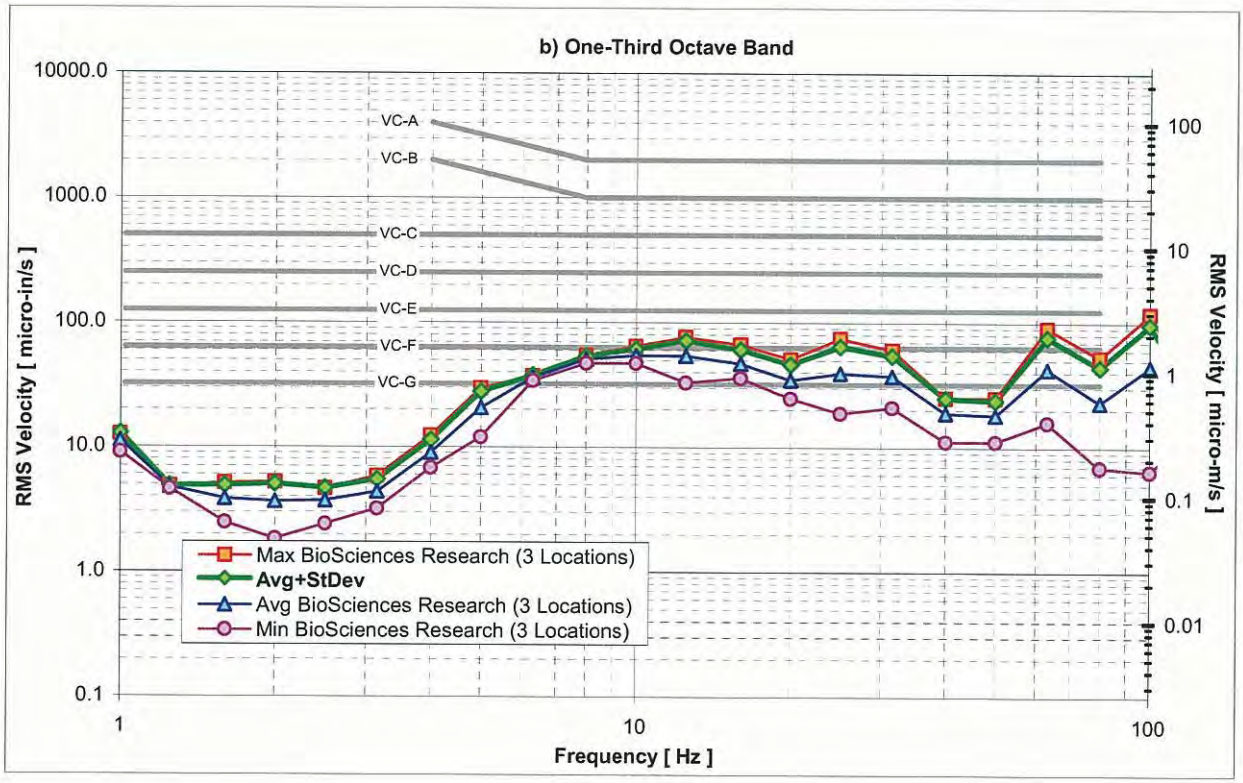
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: AV Williams Building (9 Data Points at 9 Locations)



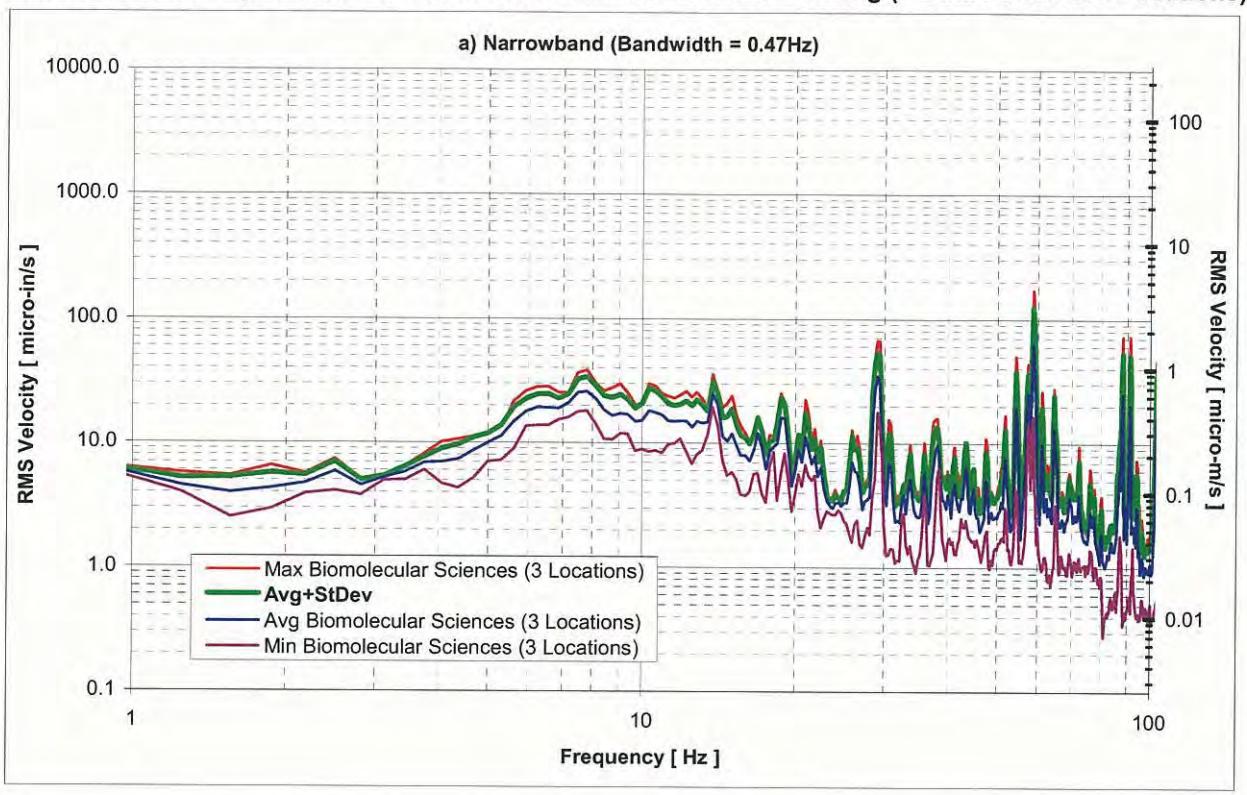


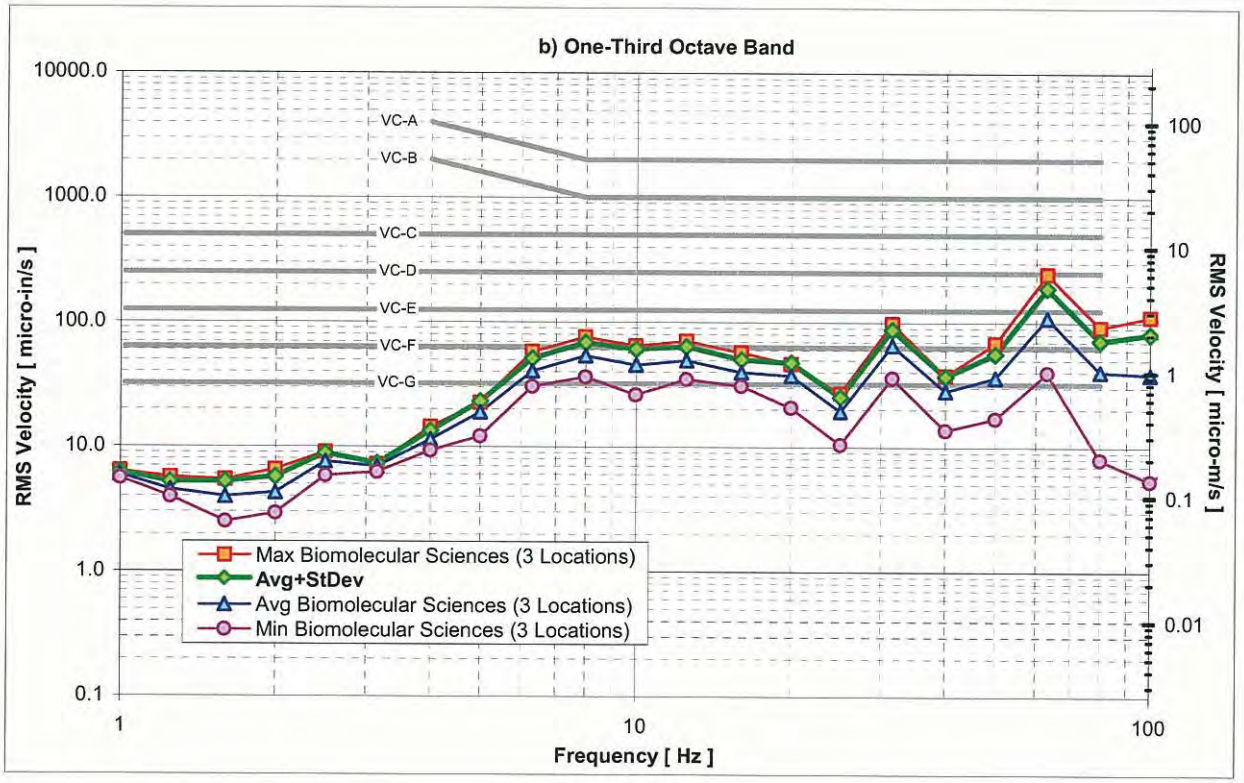
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Biosciences Research Building (3 Data Points at 3 Locations)



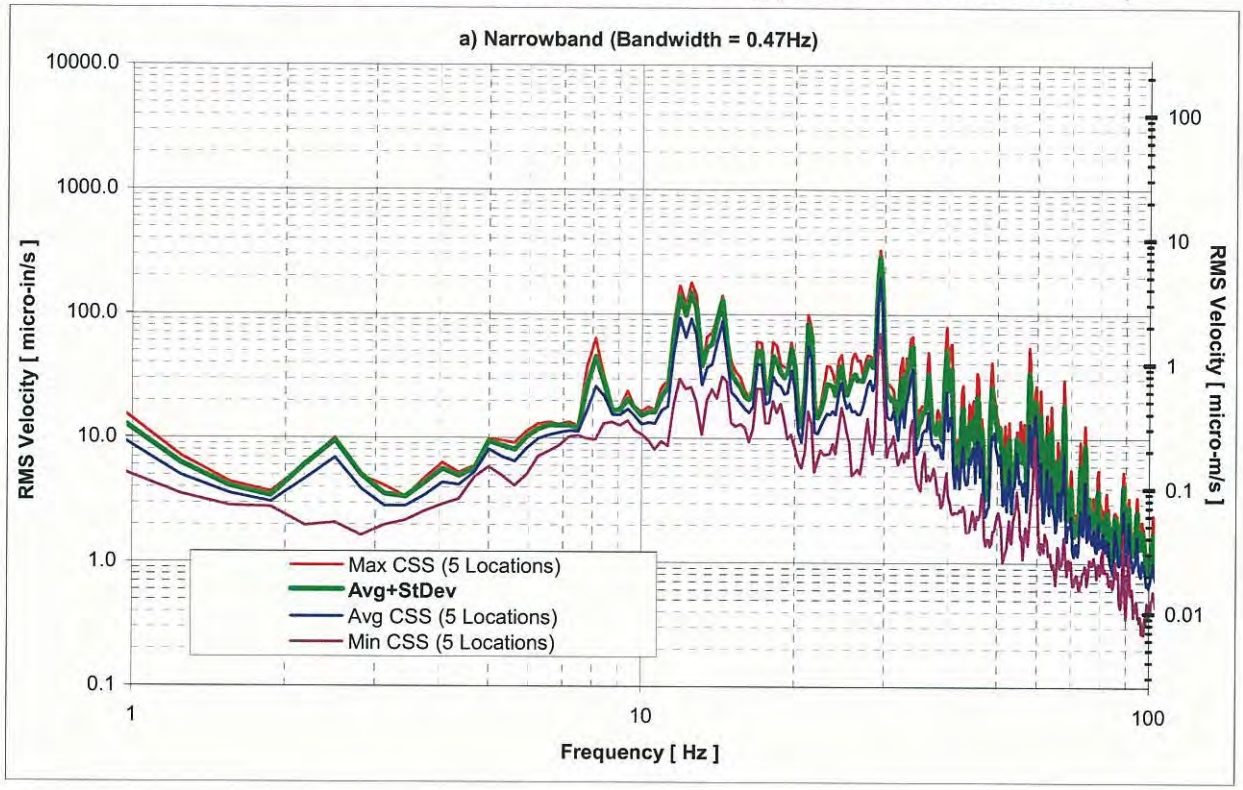


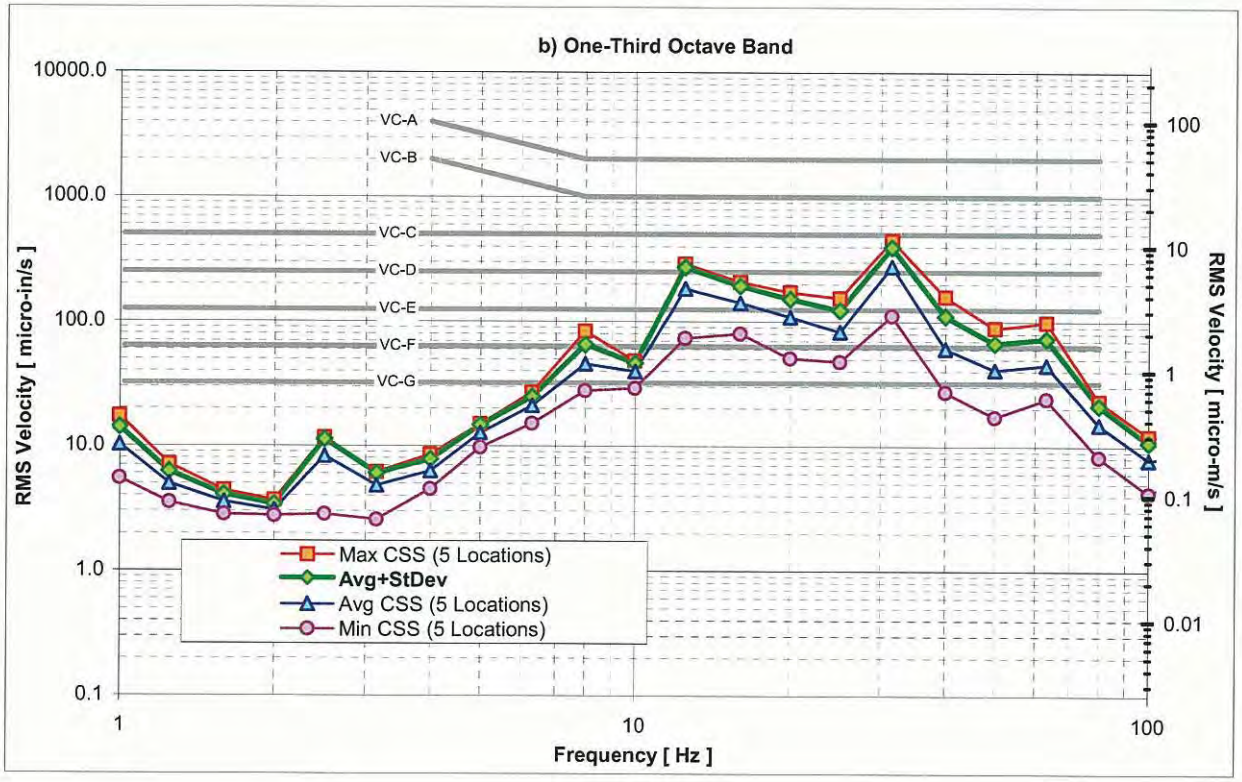
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Biomolecular Sciences Building (3 Data Points at 3 Locations)



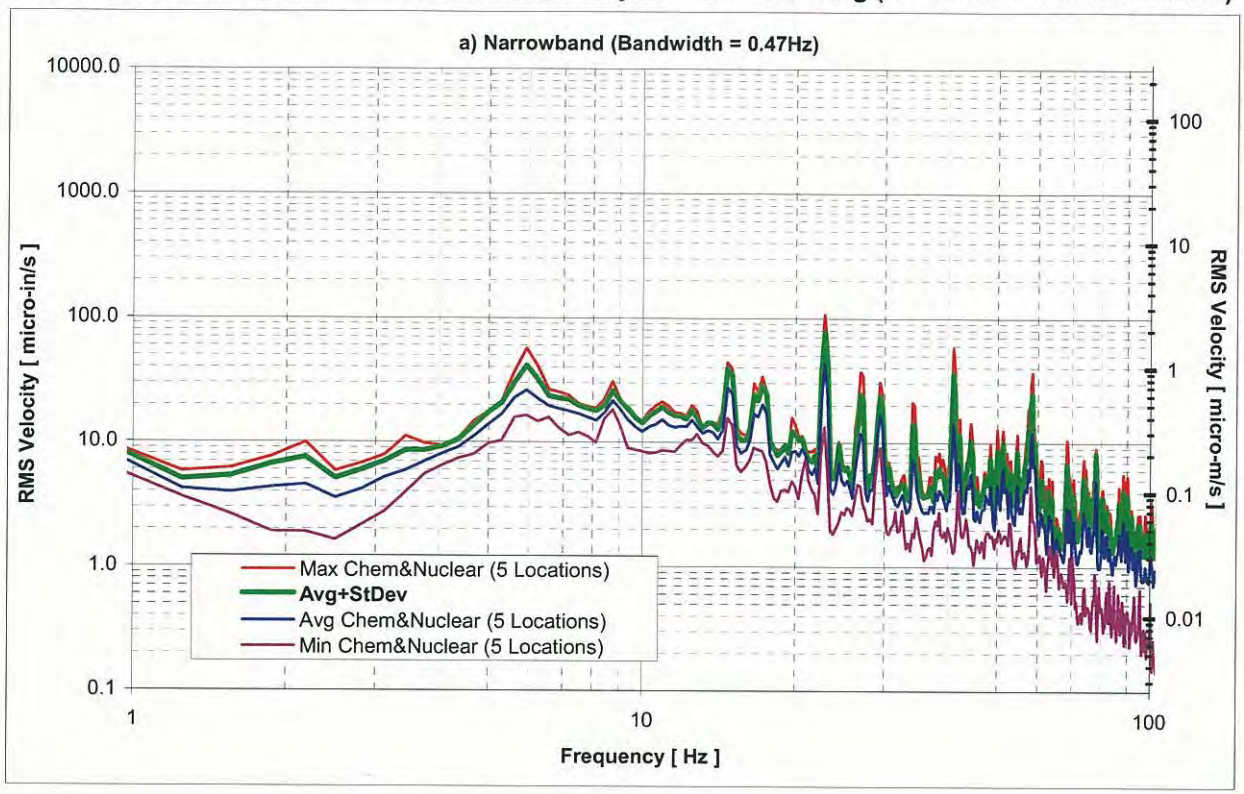


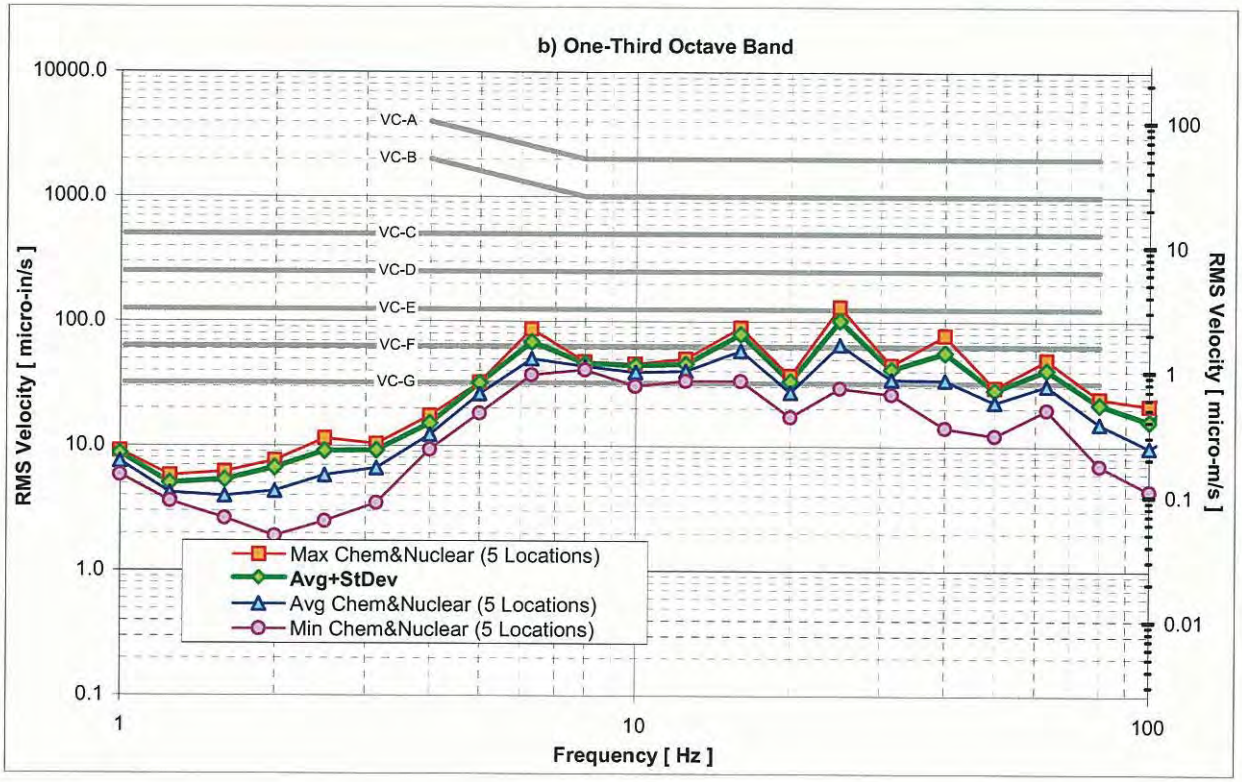
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: CSS Building (5 Data Points at 5 Locations)



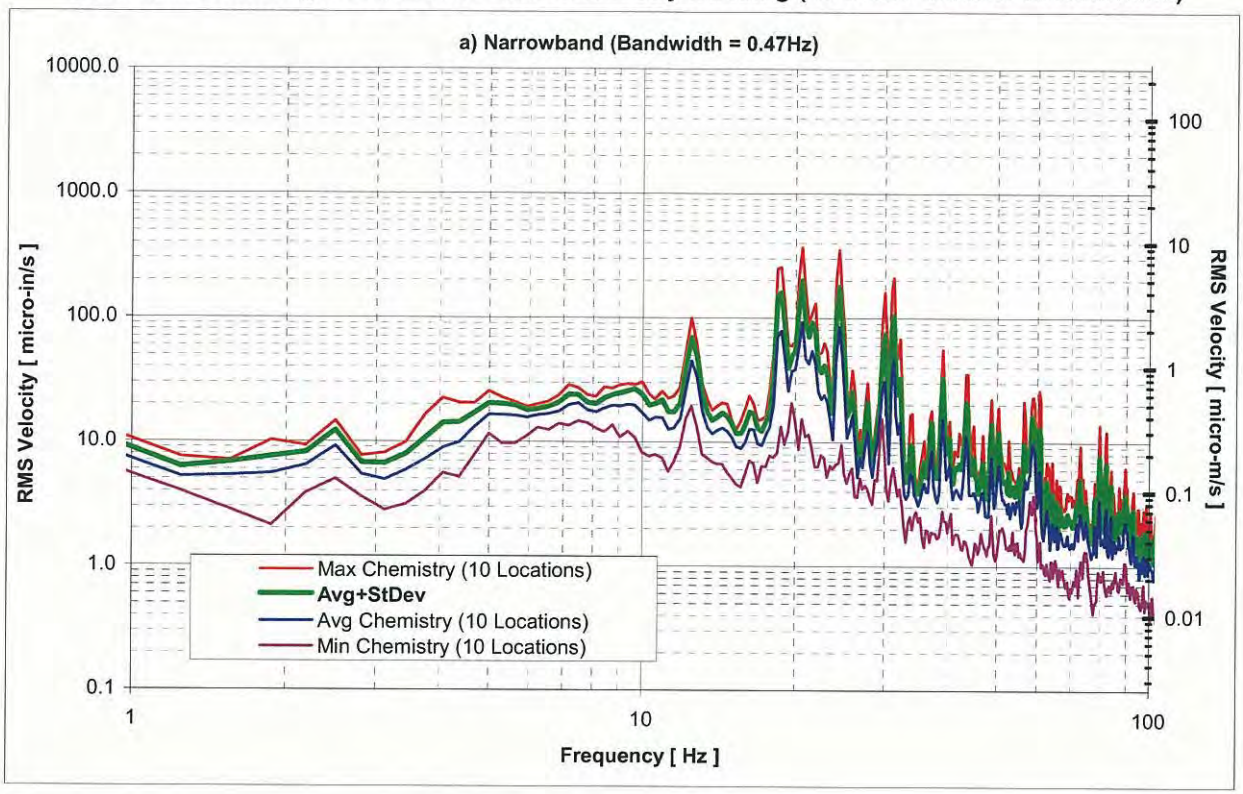


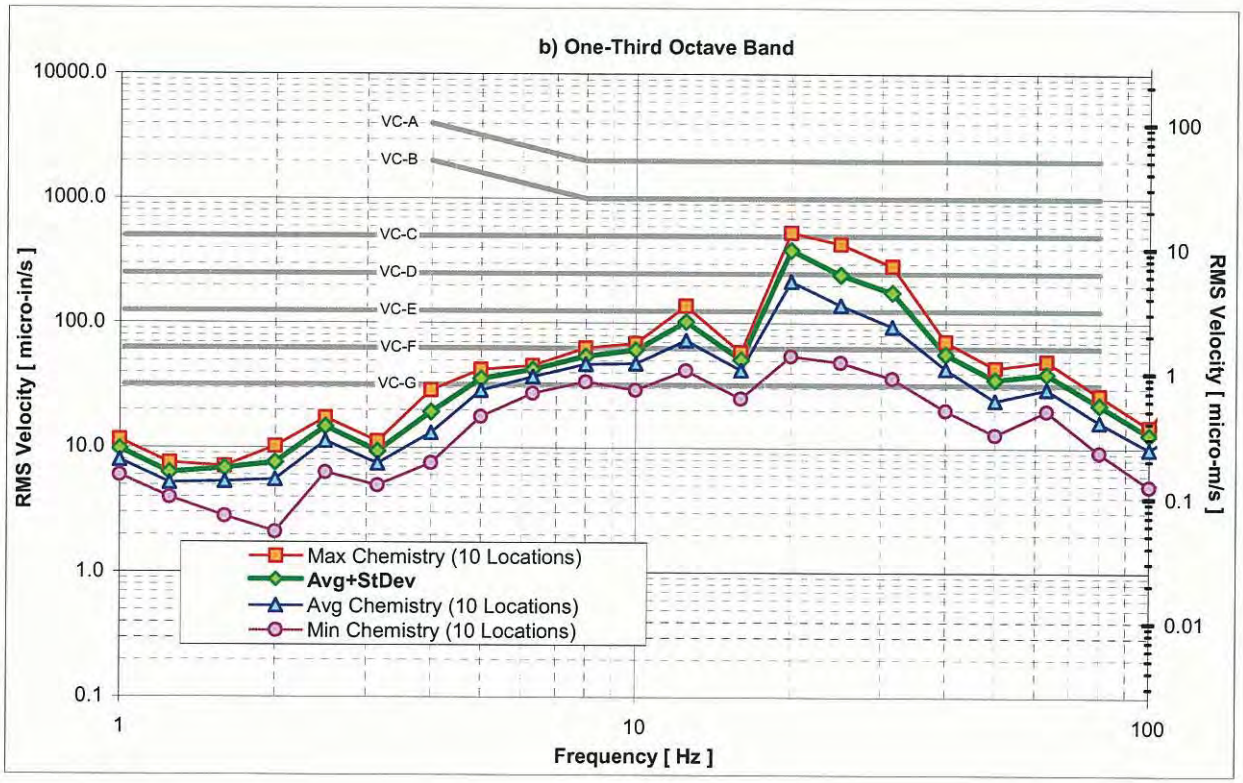
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Chemistry & Nuclear Building (5 Data Points at 5 Locations)



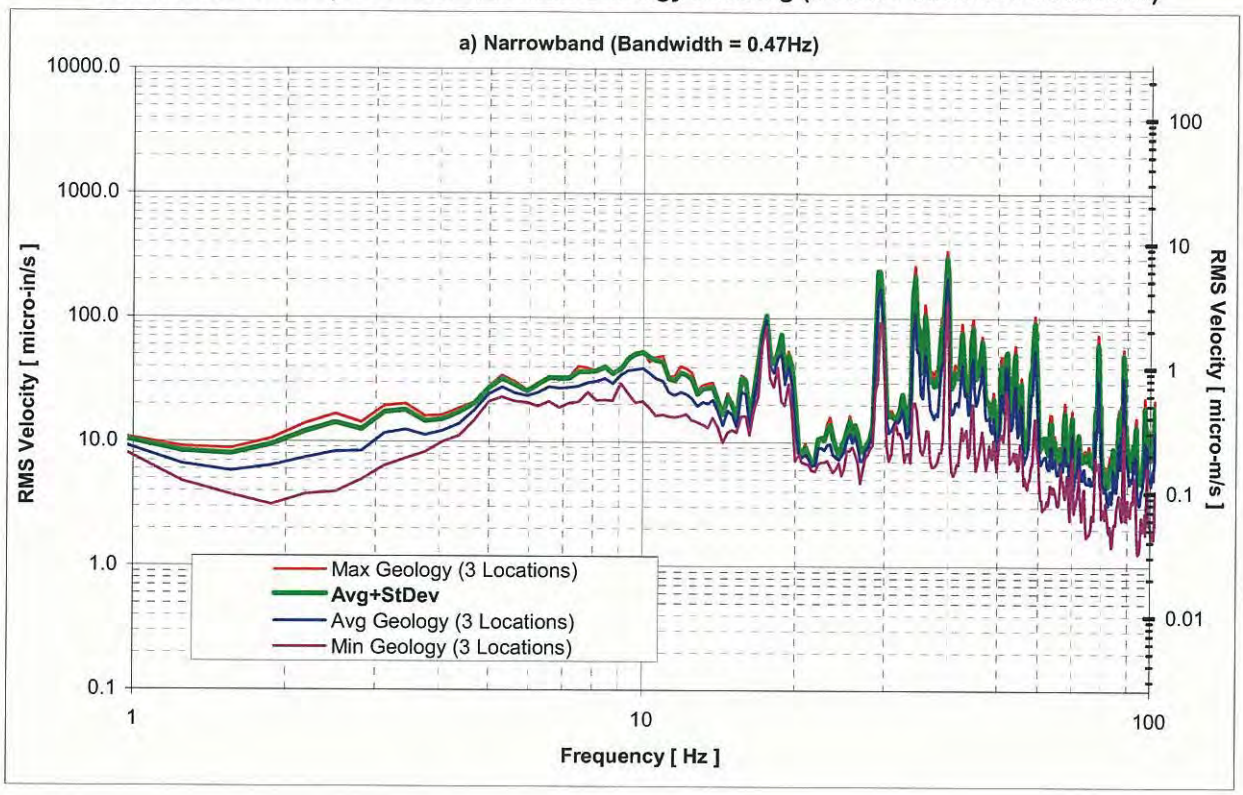


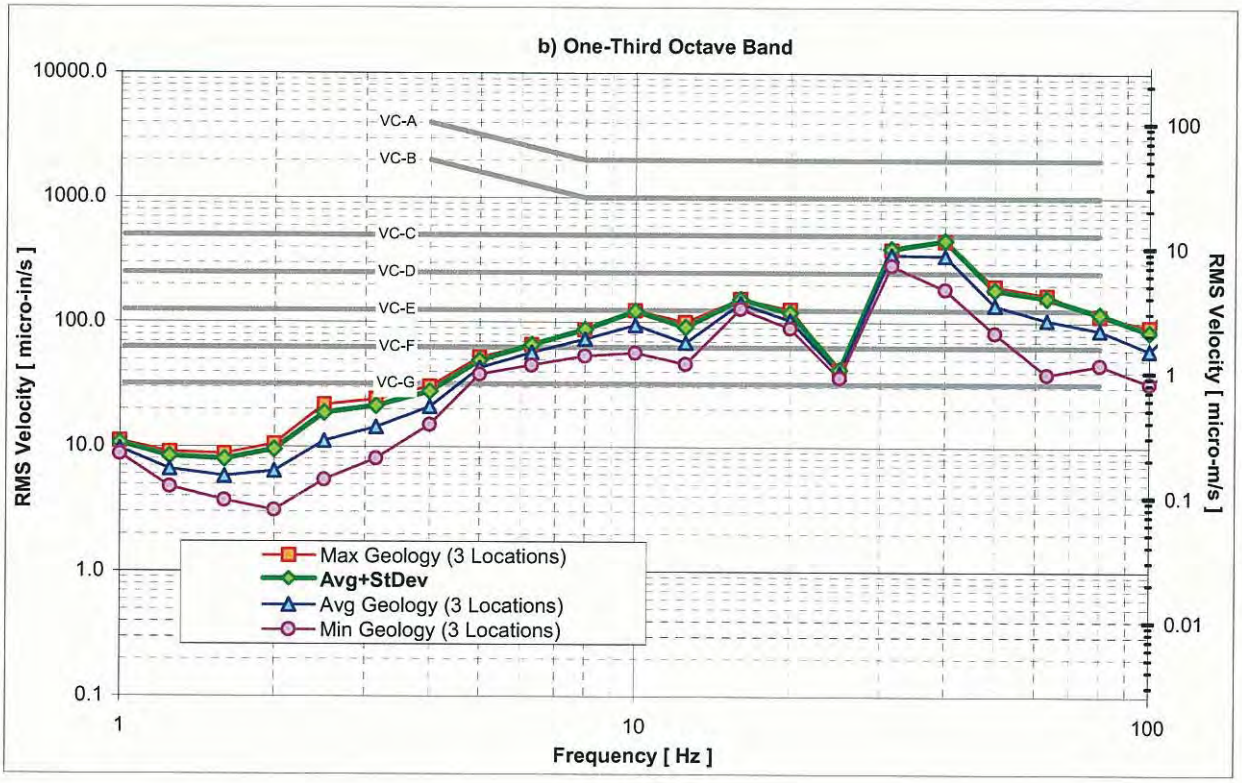
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Chemistry Building (10 Data Points at 10 Locations)



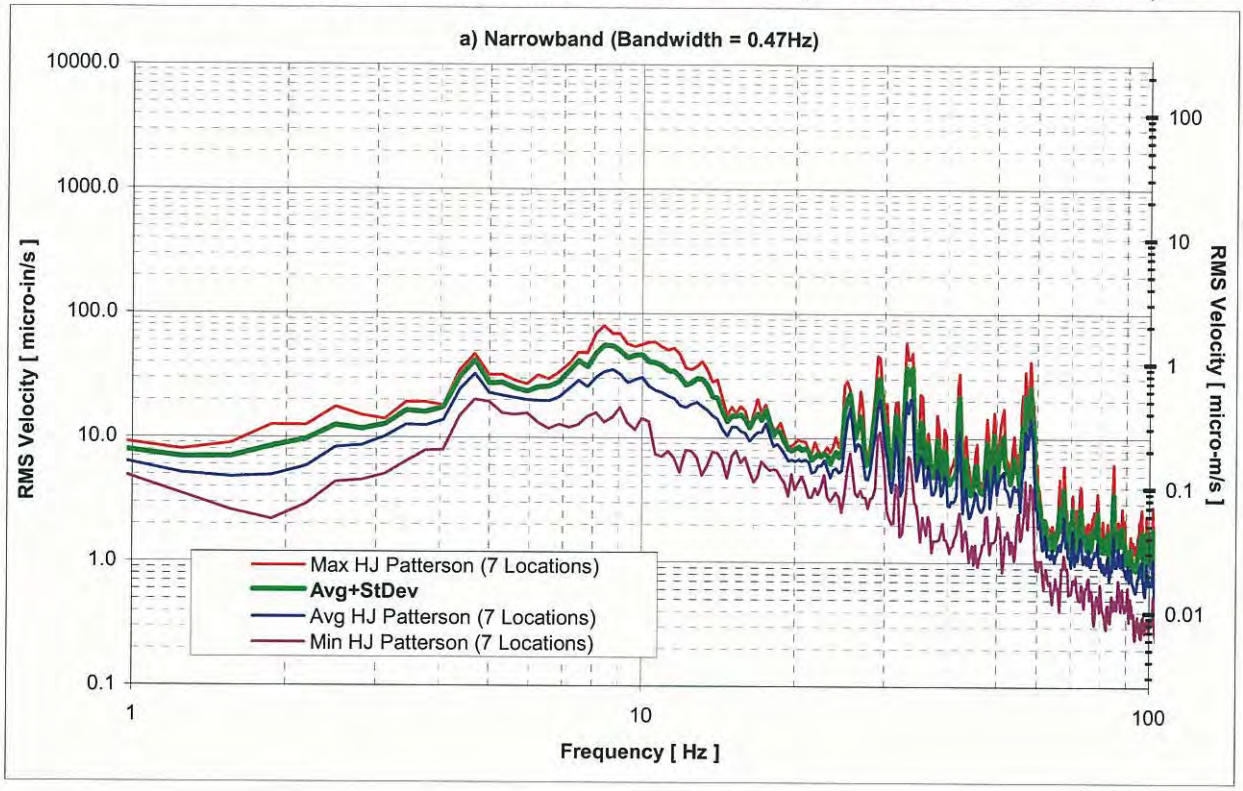


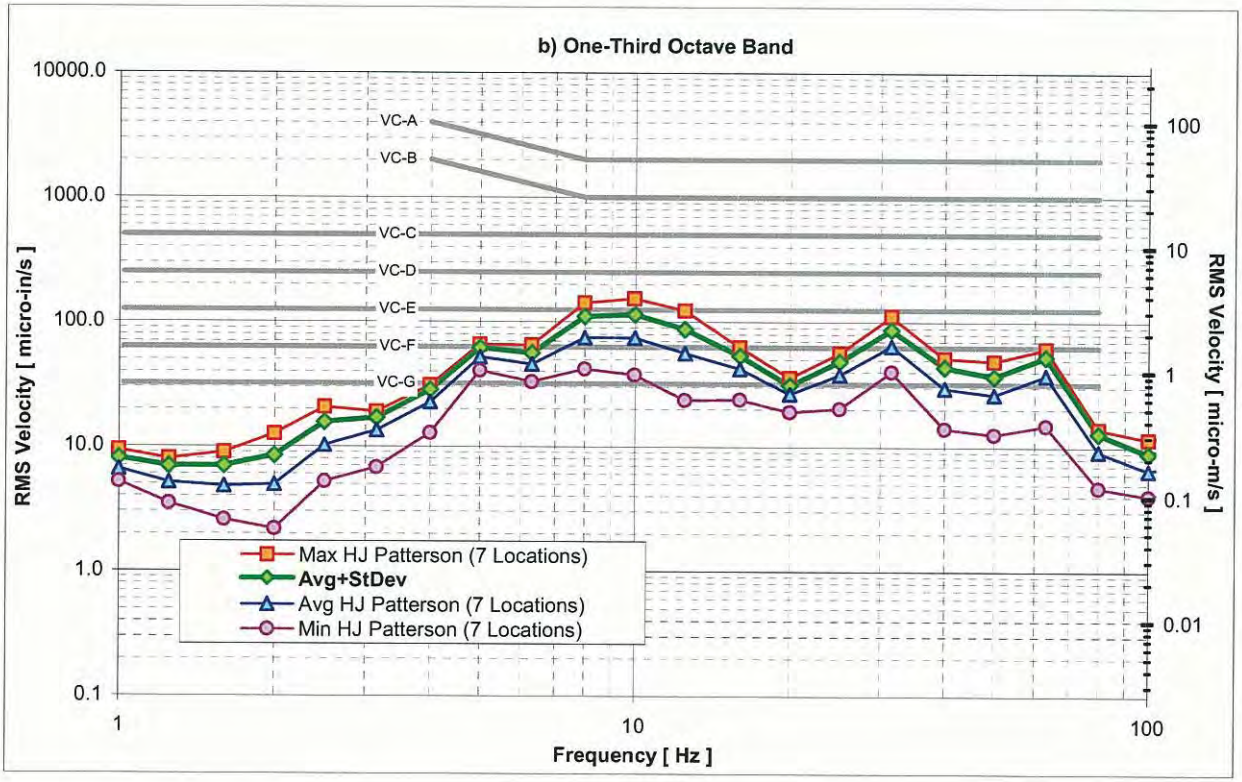
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Geology Building (3 Data Points at 3 Locations)



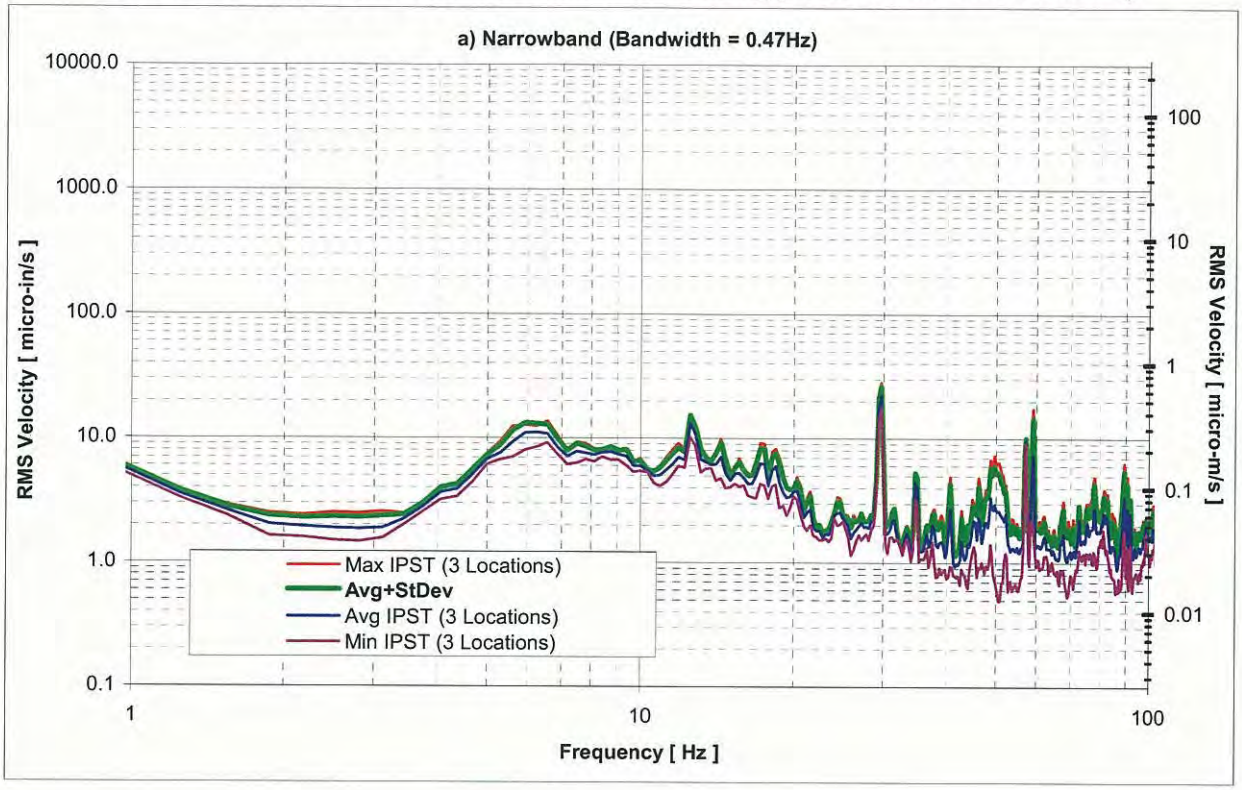


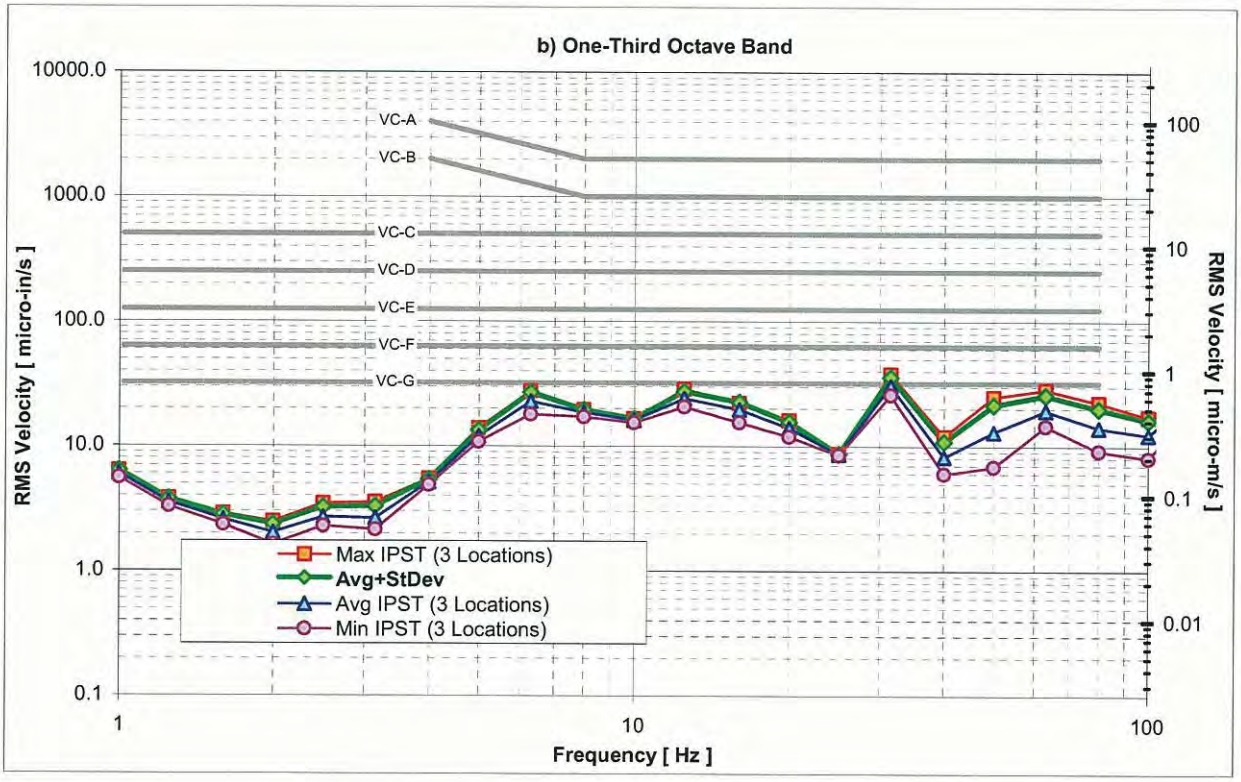
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: HJ Patterson Hall (7 Data Points at 7 Locations)



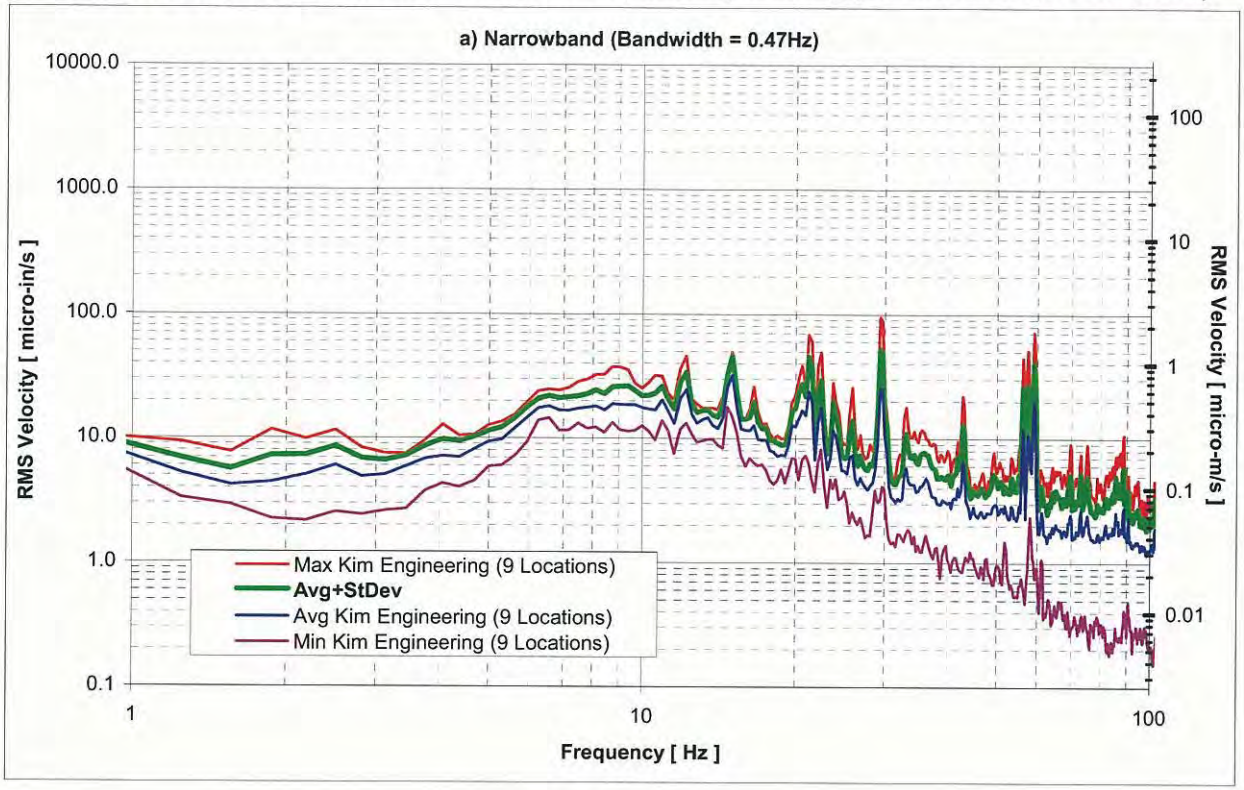


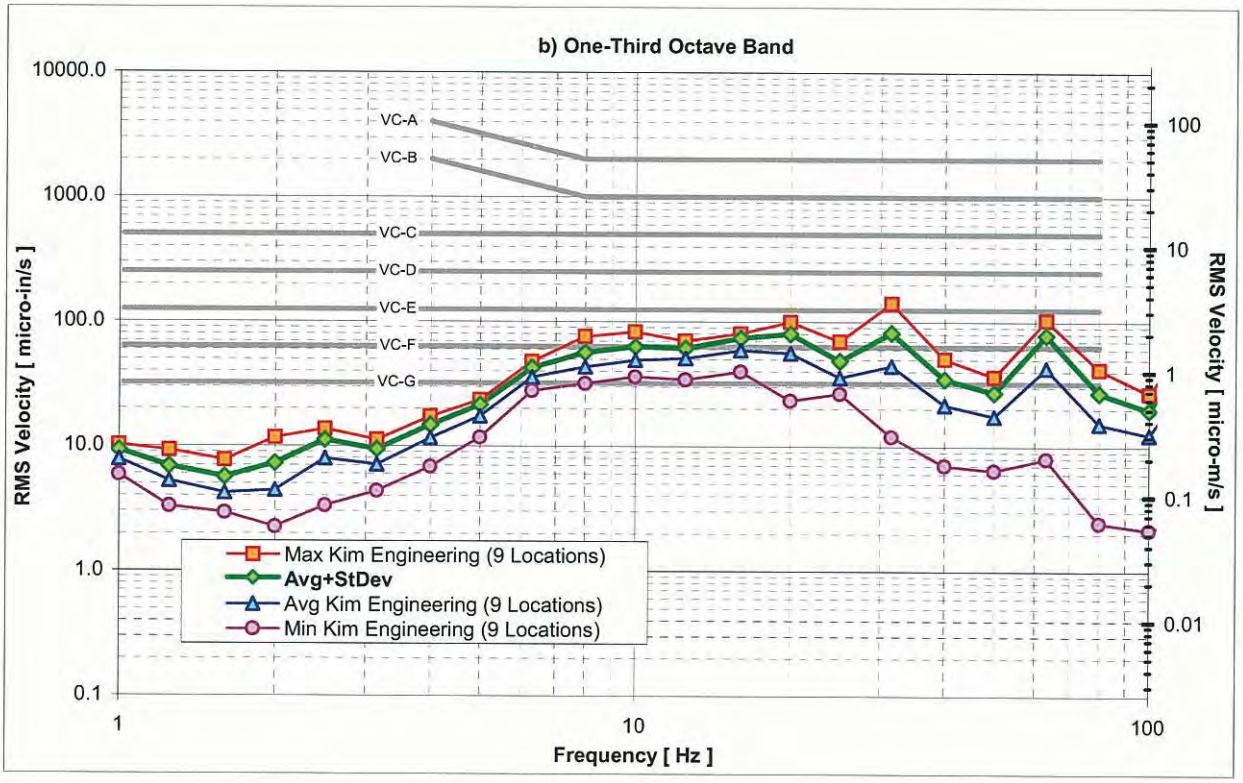
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: IPST Building (3 Data Points at 3 Locations)



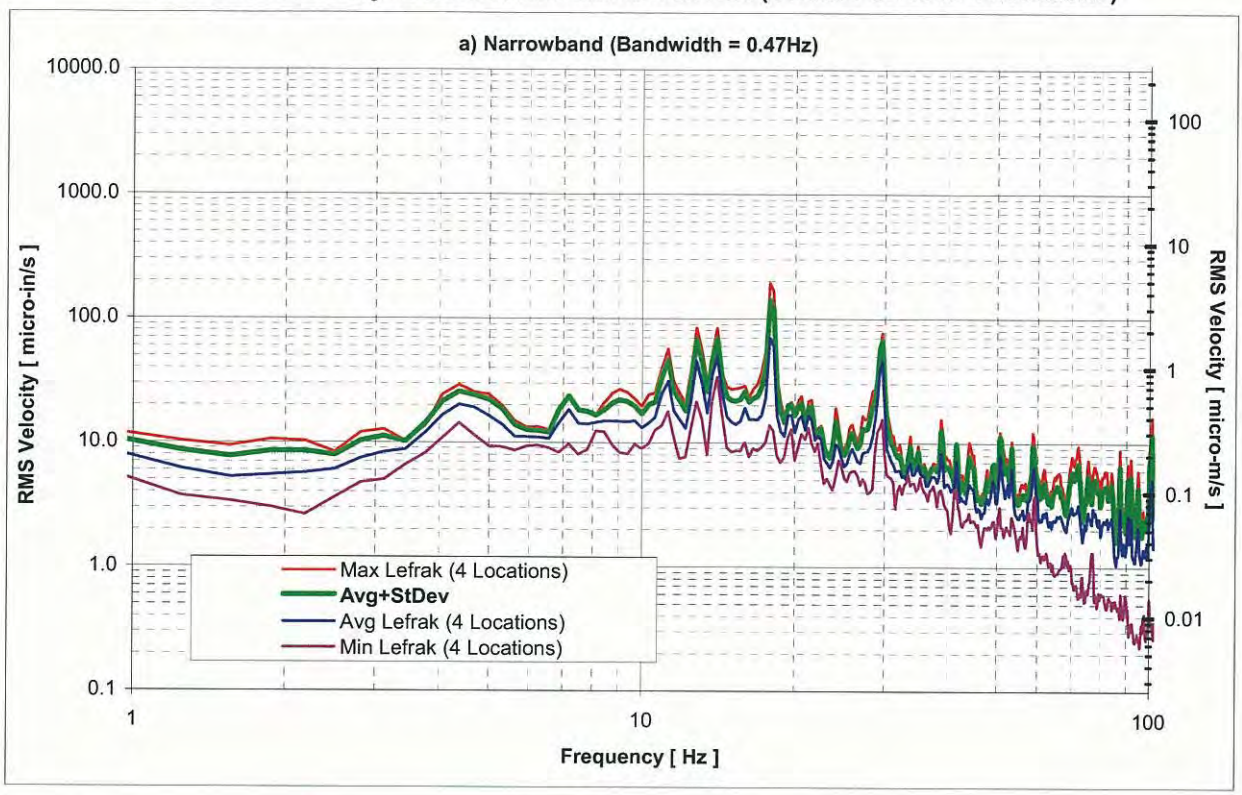


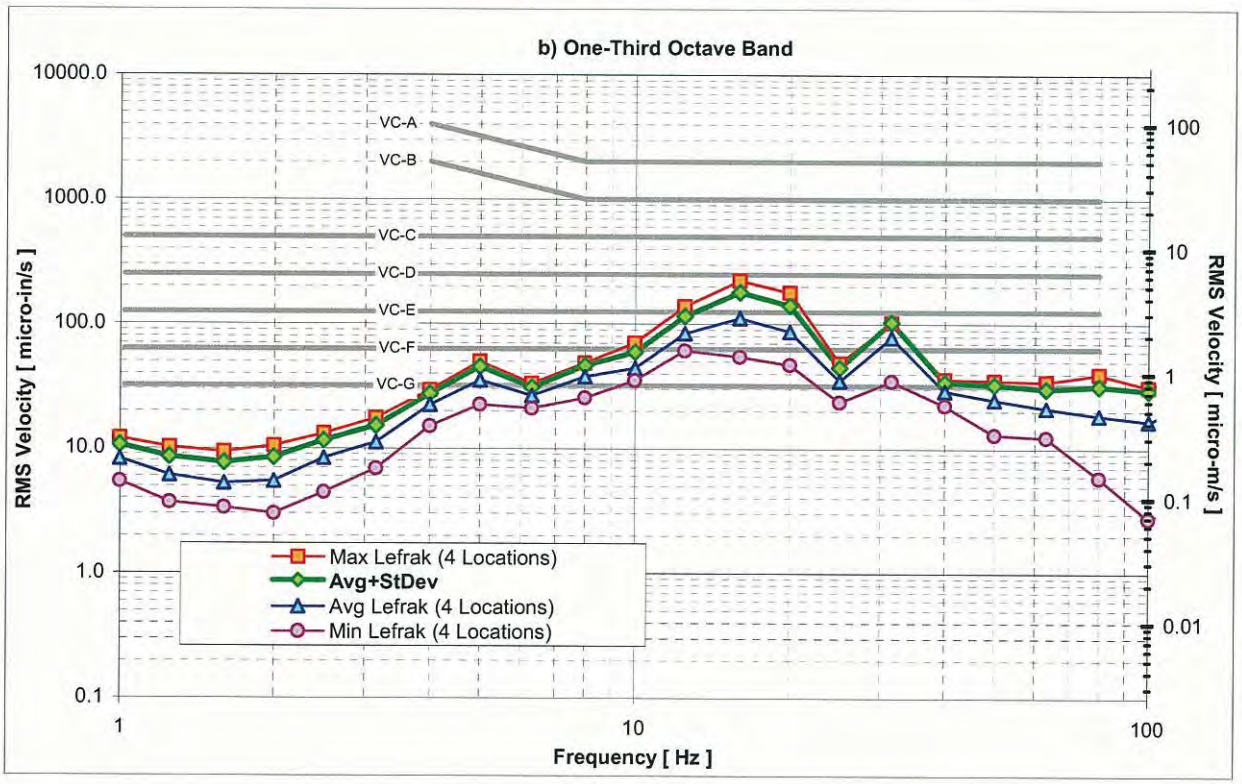
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Kim Engineering Building (9 Data Points at 9 Locations)



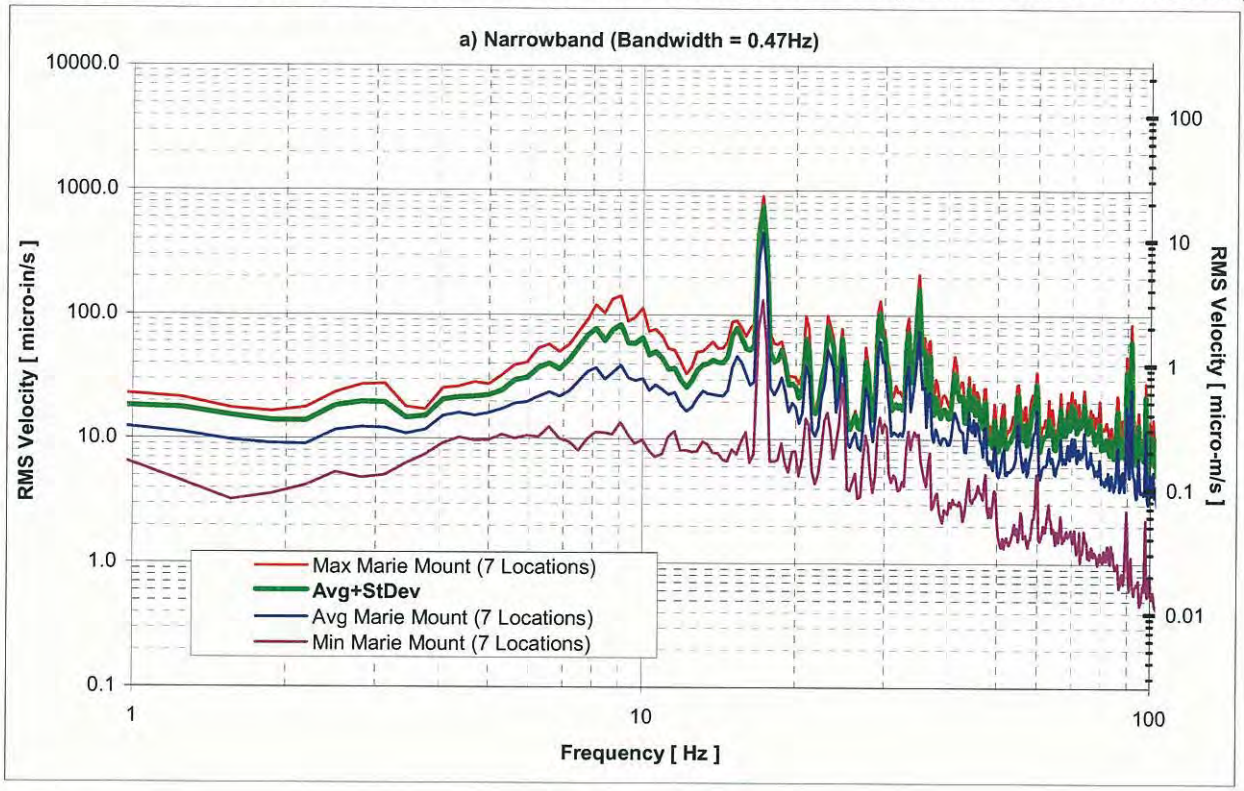


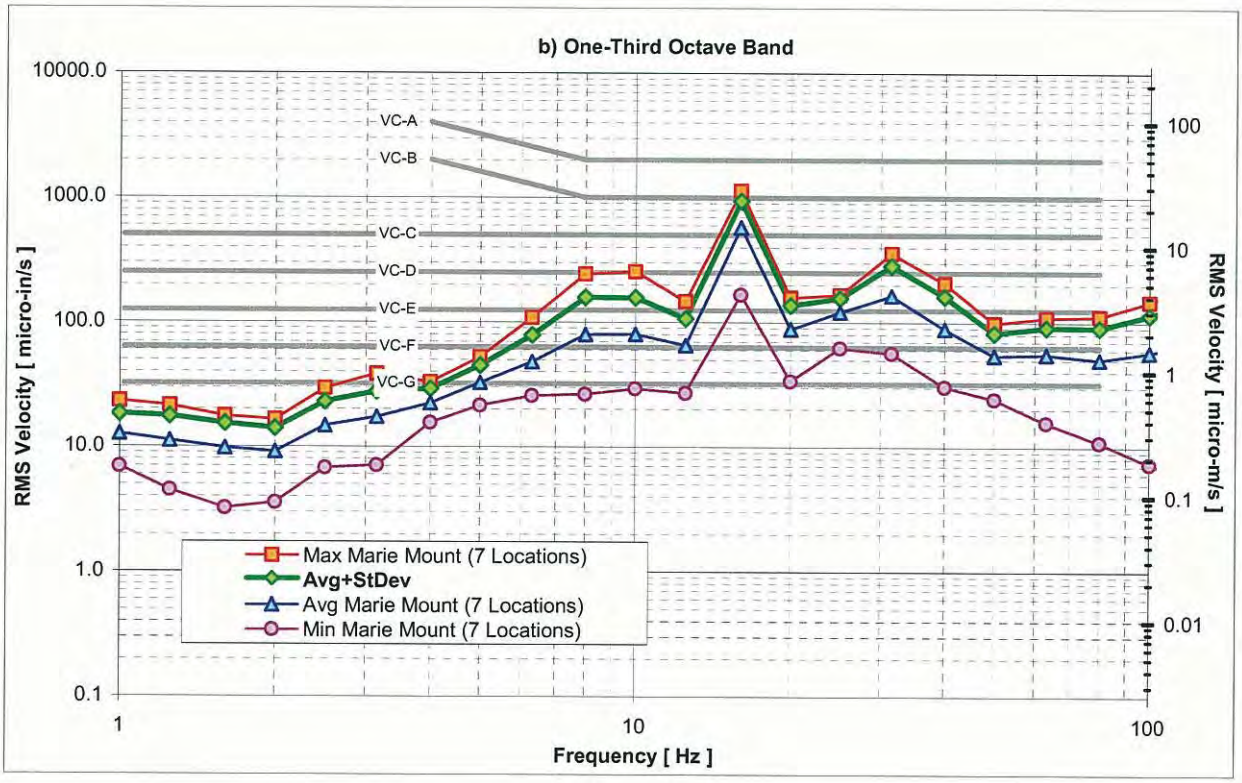
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Lefrak Hall (4 Data Points at 4 Locations)



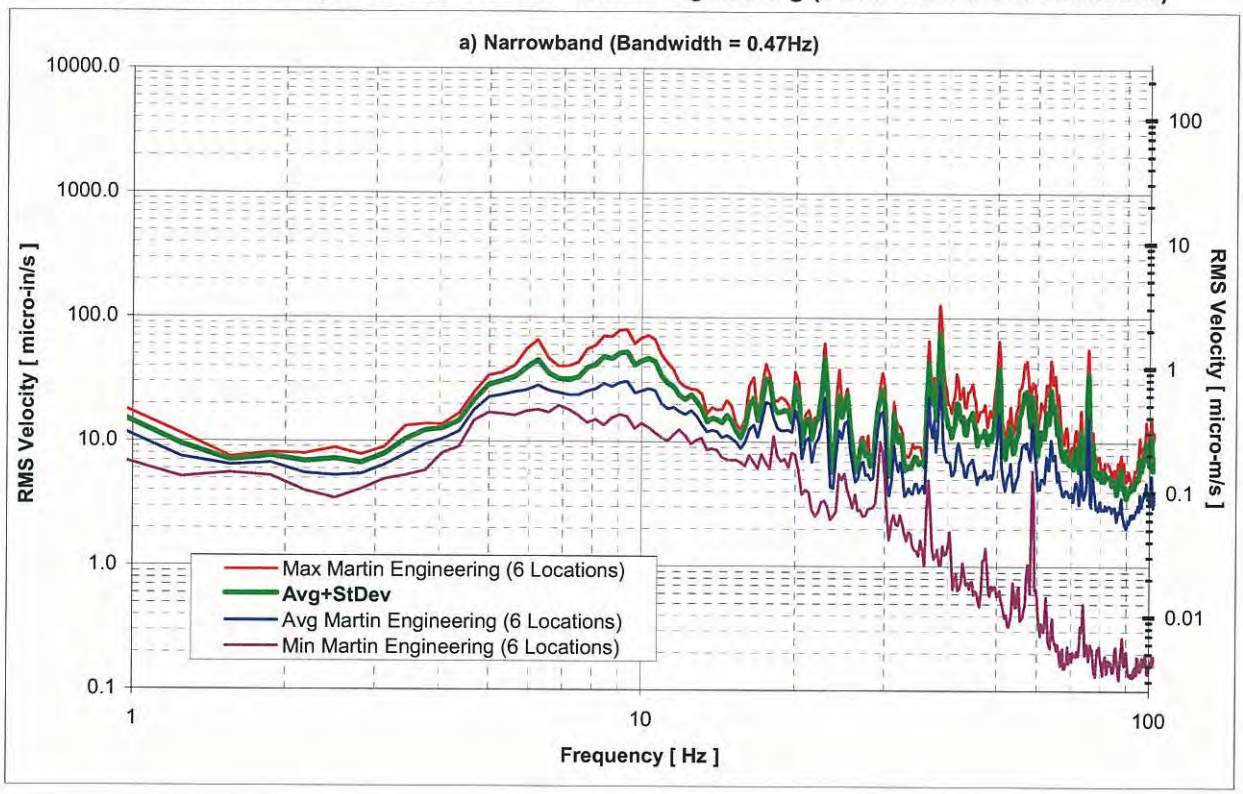


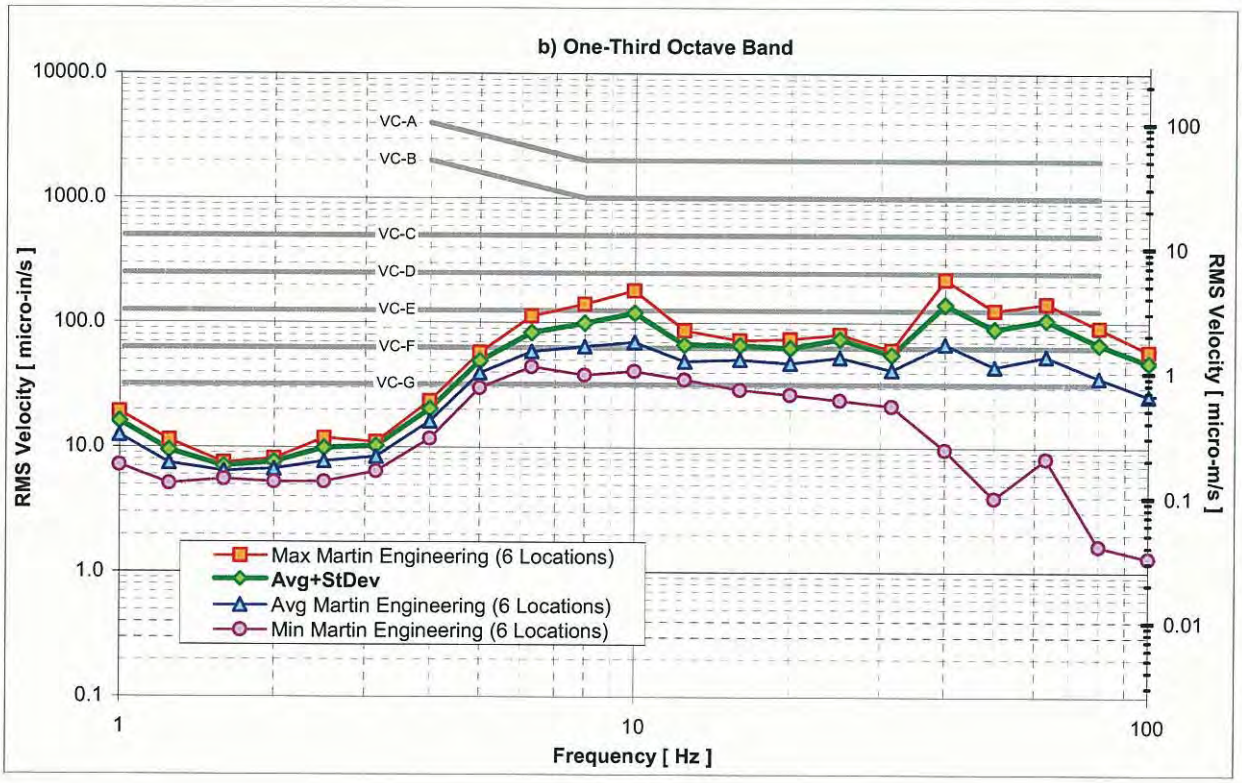
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Marie-Mount Building / MEG Lab (7 Data Points at 7 Locations)



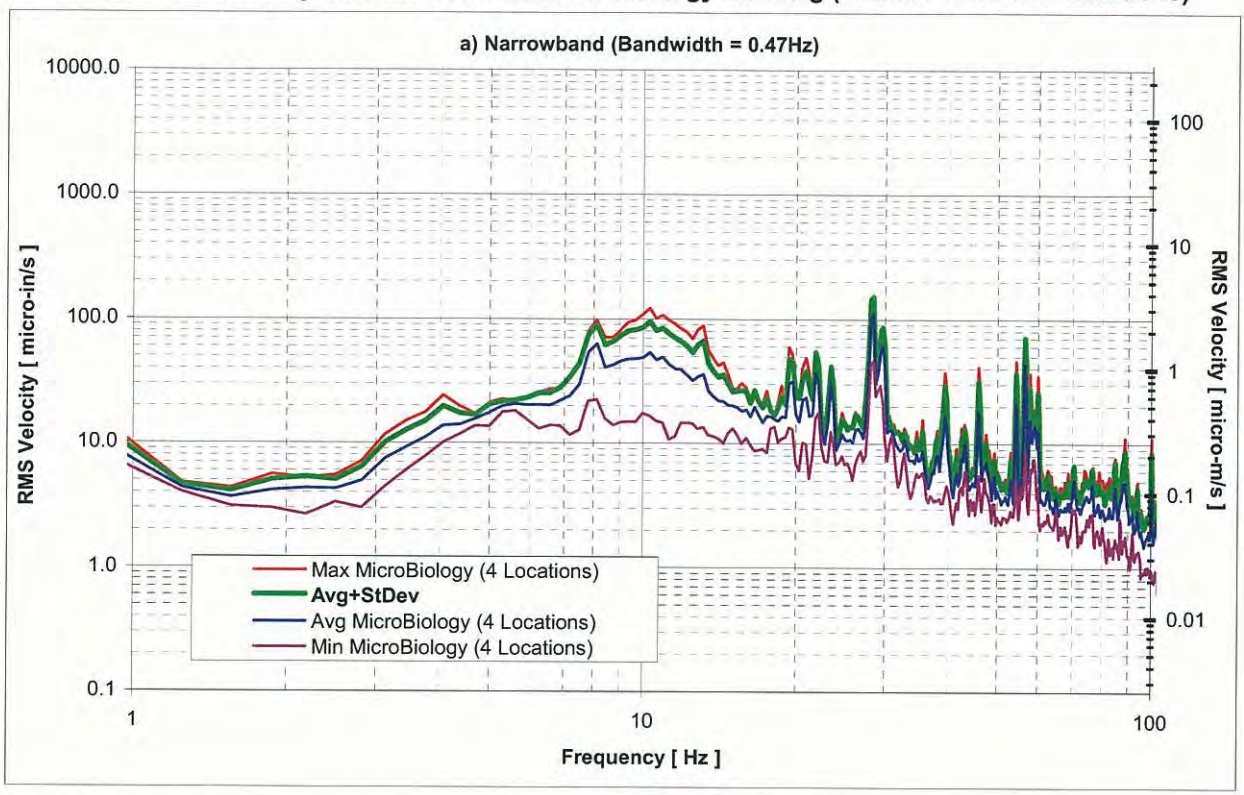


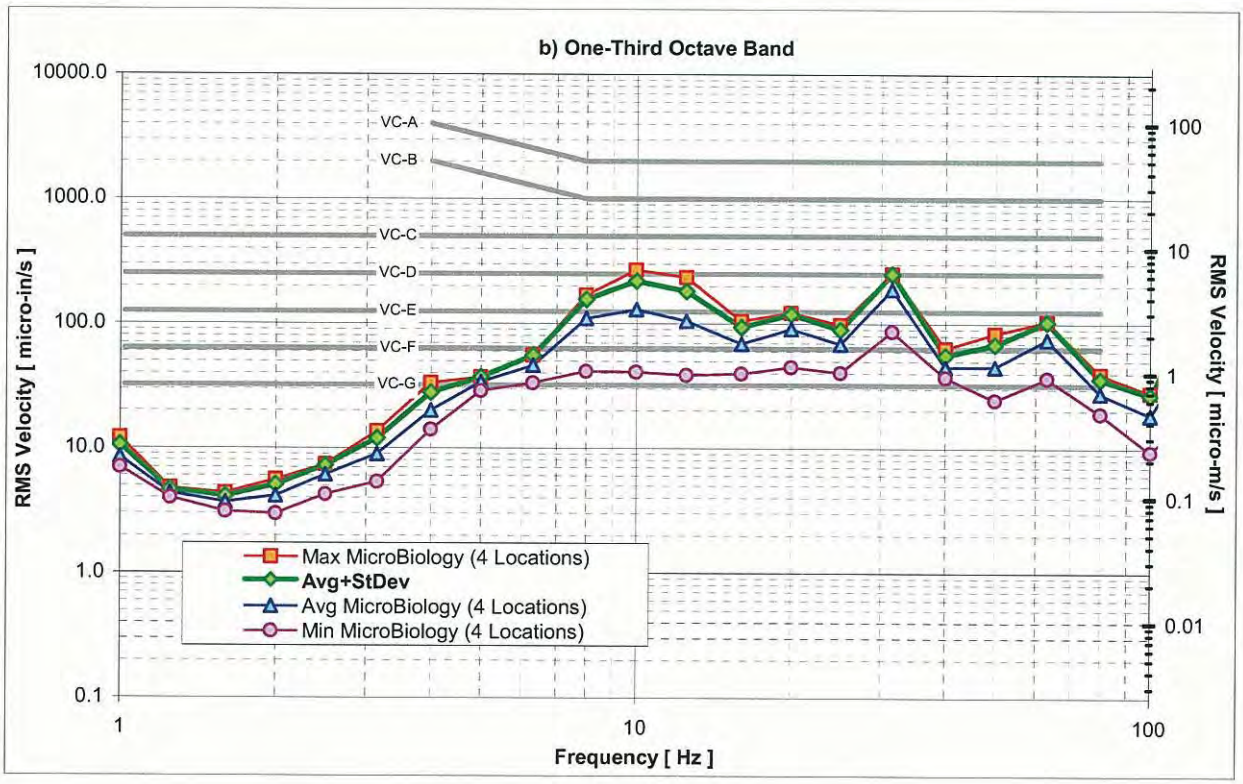
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Martin Engineering (6 Data Points at 6 Locations)



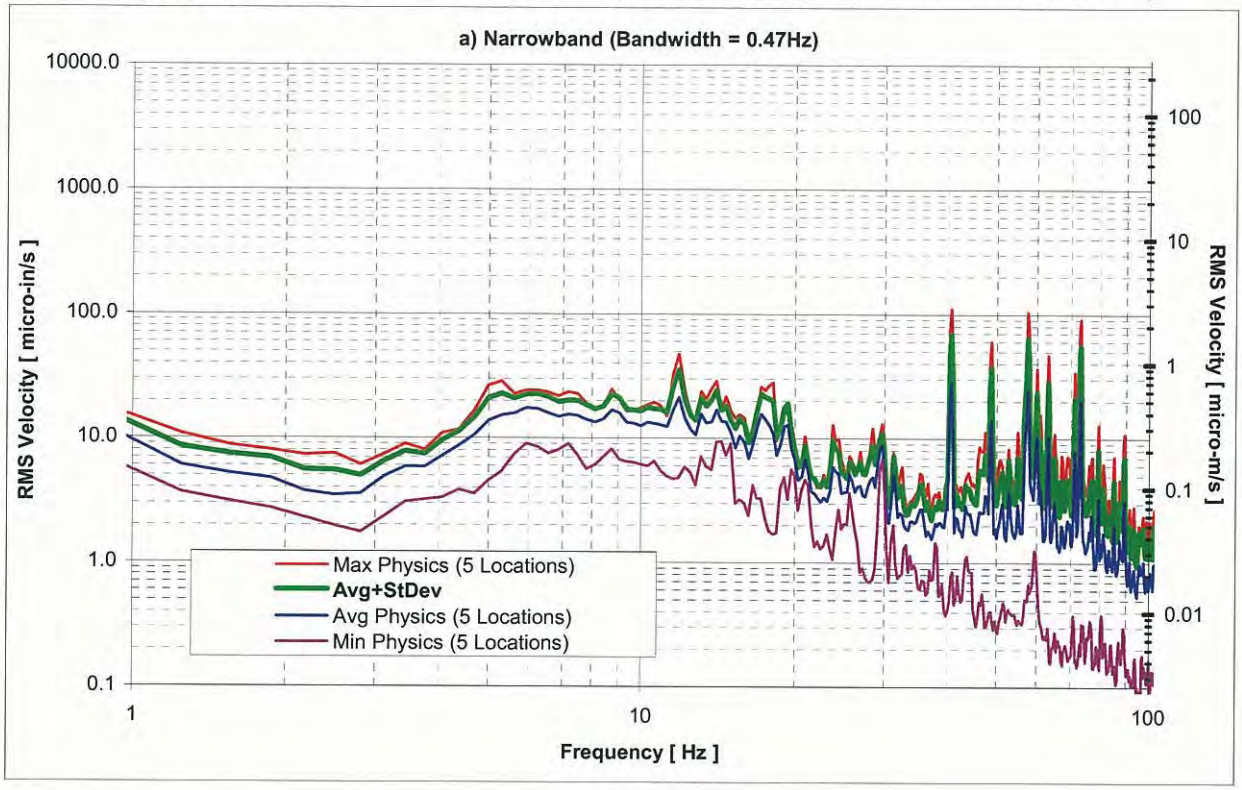


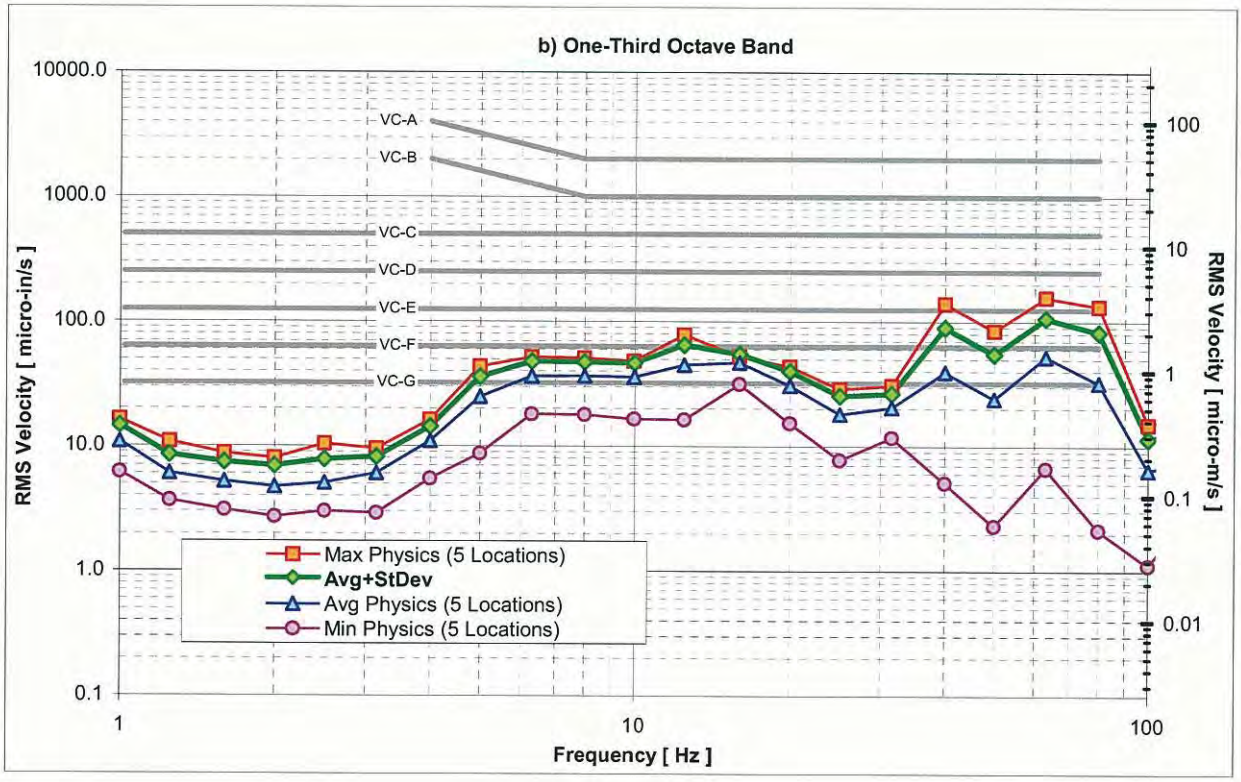
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: MicroBiology Building (4 Data Points at 4 Locations)



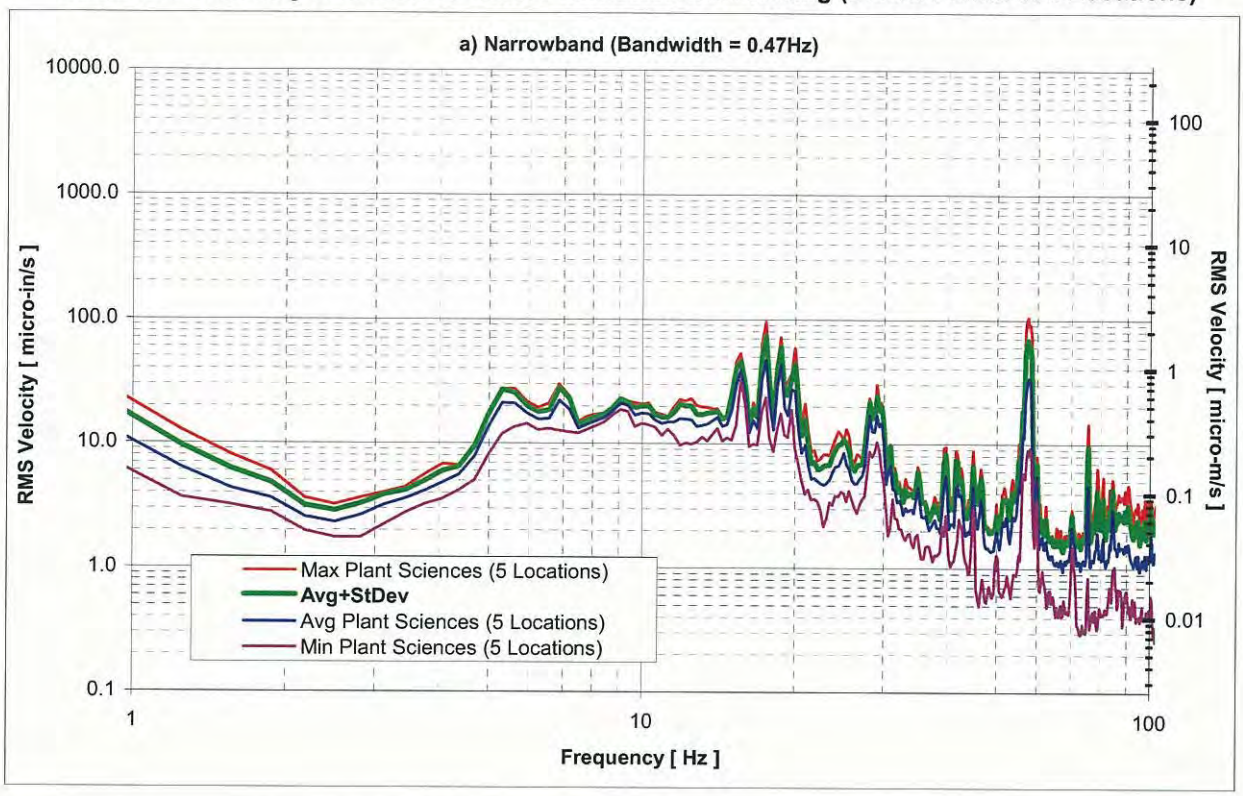


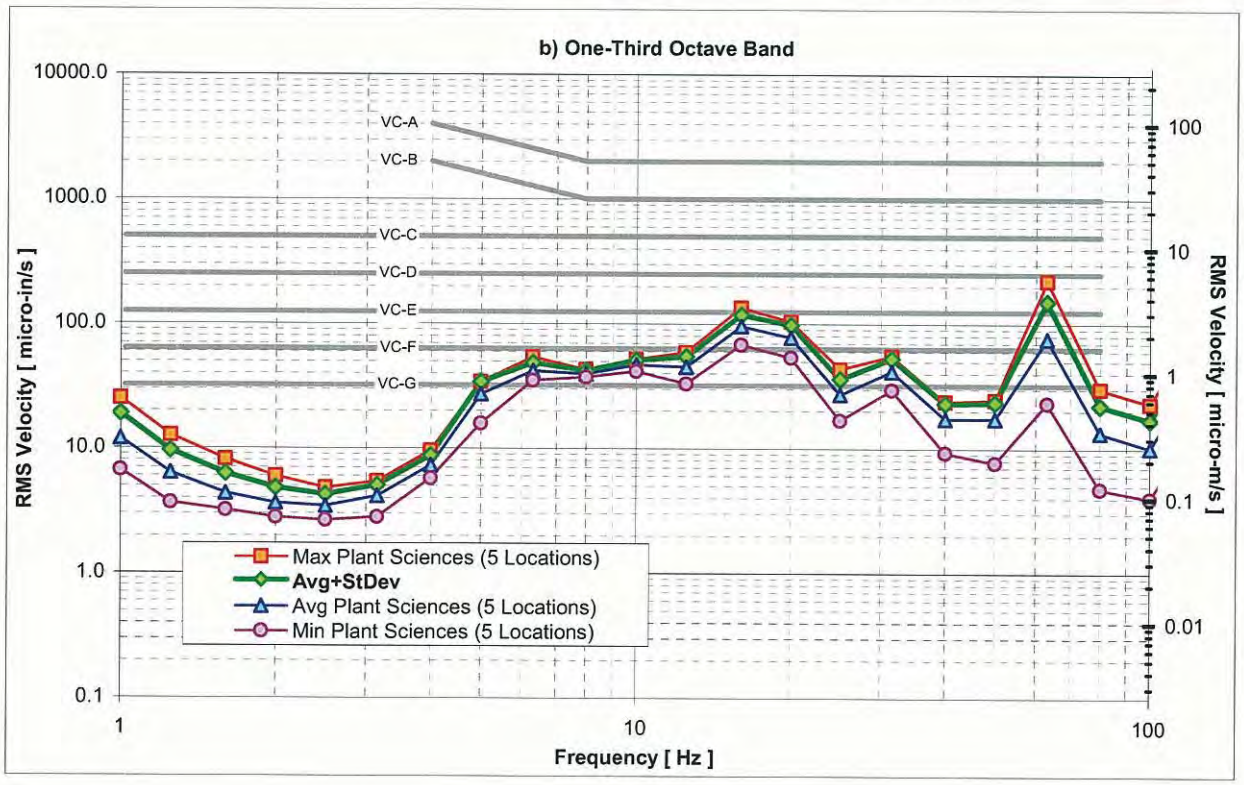
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Physics Building (5 Data Points at 5 Locations)



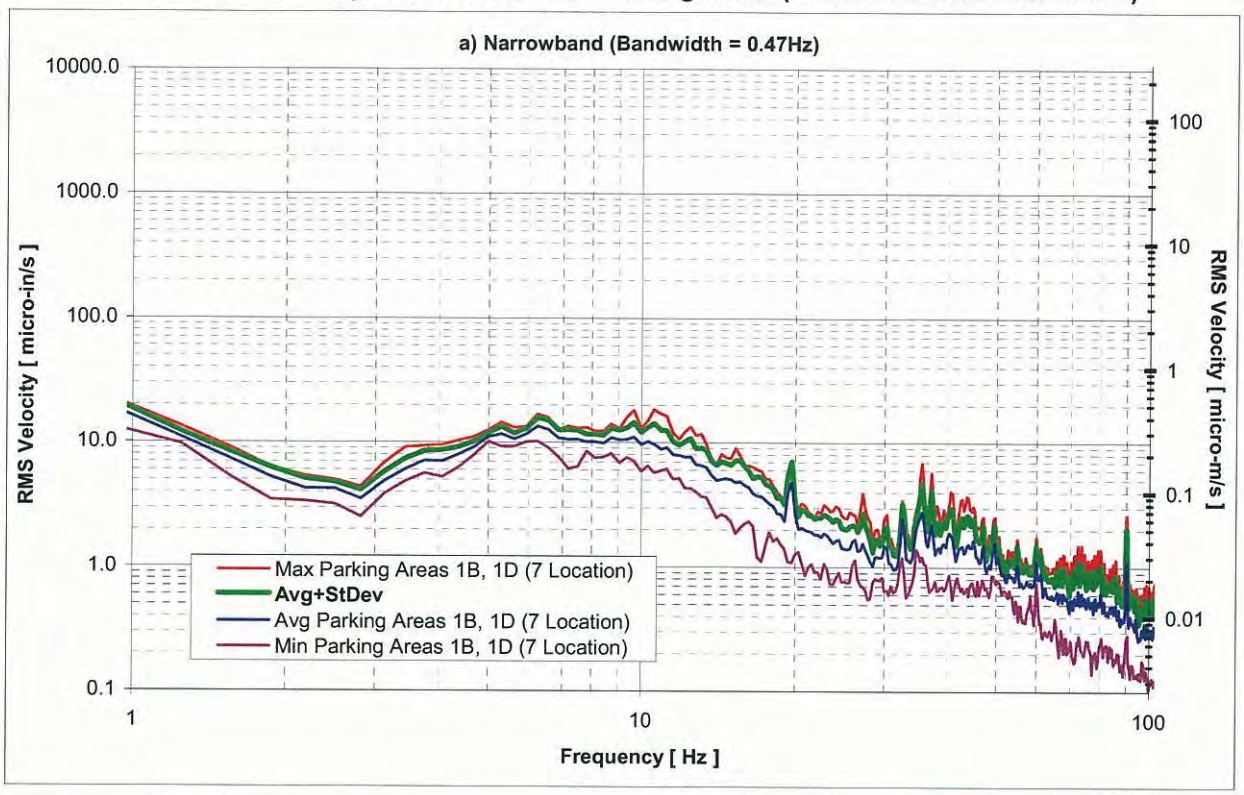


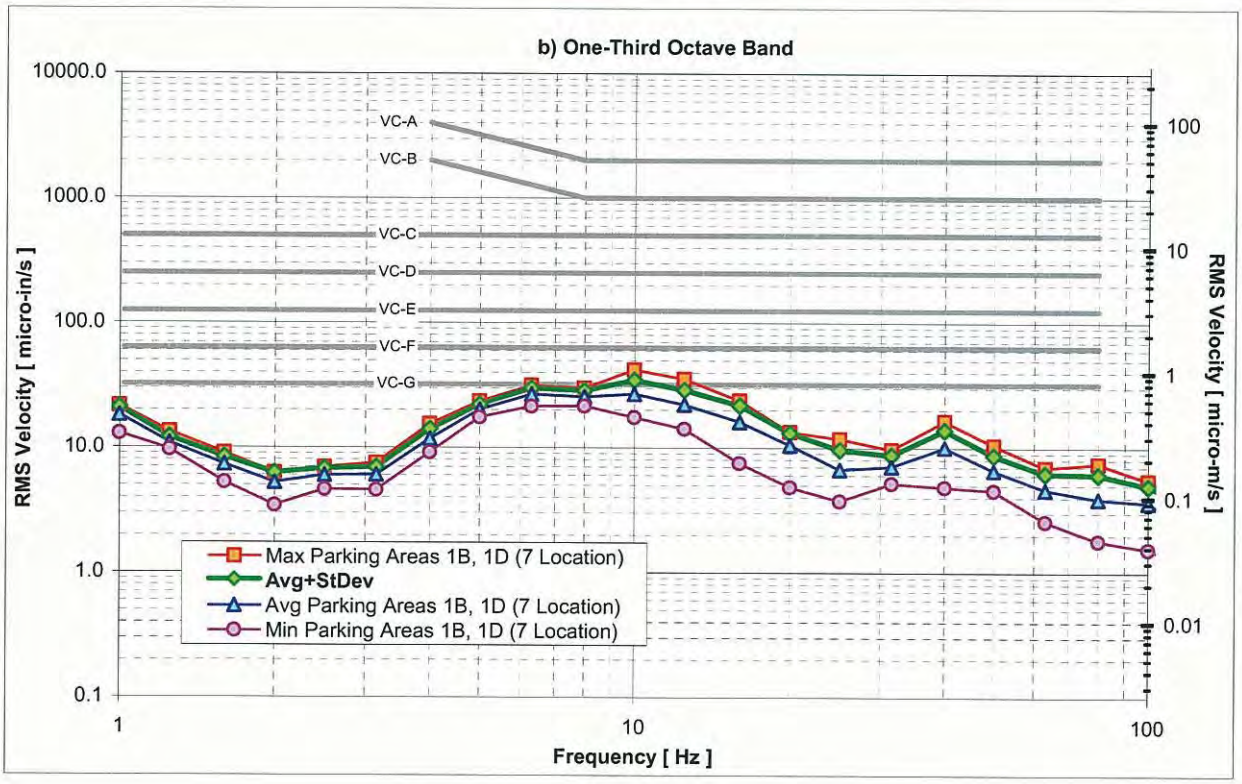
Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Plant Sciences Building (5 Data Points at 5 Locations)



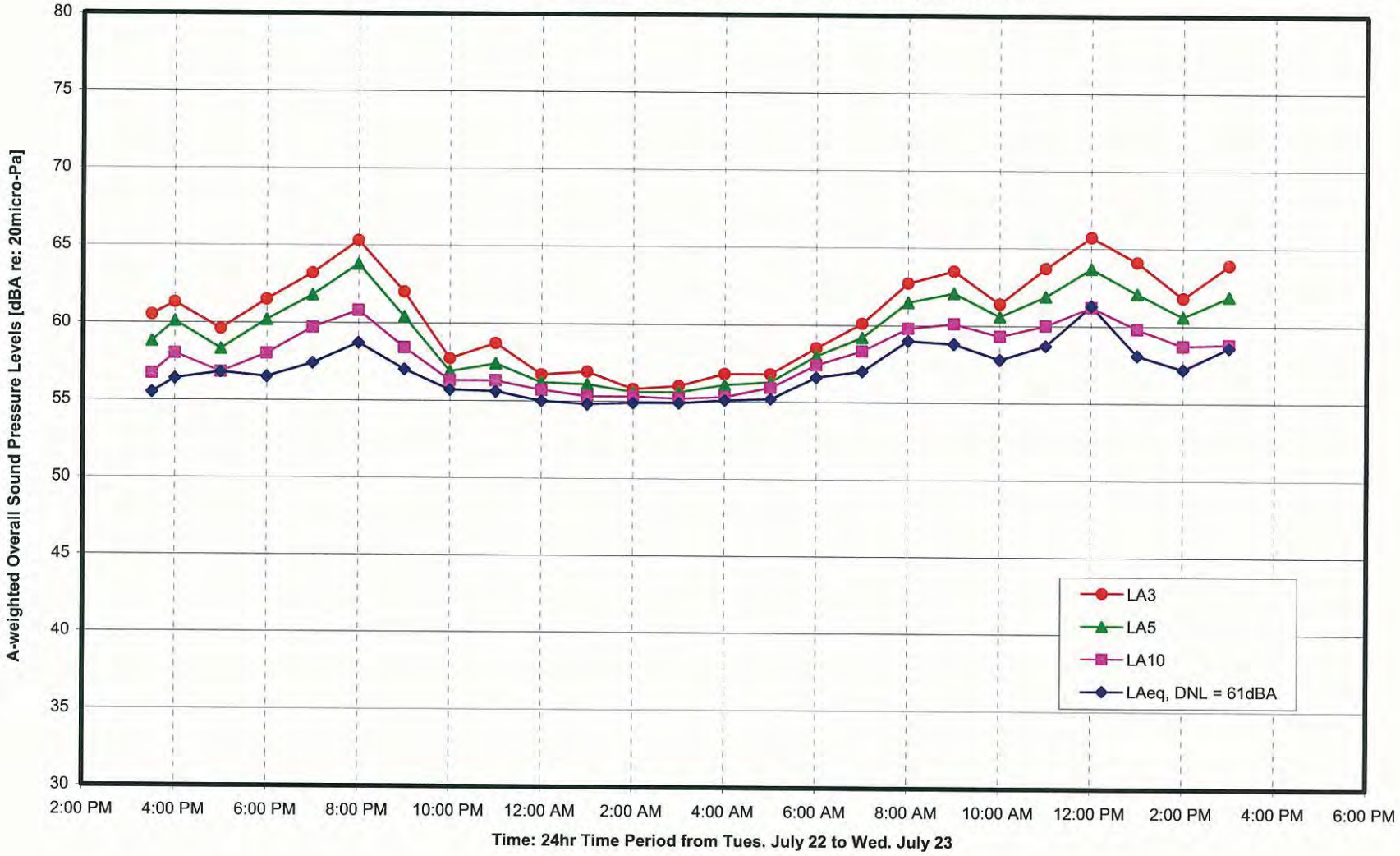


Appendix B: UMD Campus Vibration Survey / Purple Line -- 22~25 July 2008
Statistical Summary of Measured Data: Parking Areas (7 Data Points at 7 Locations)





Appendix C: UMD 24-Hour Exterior Noise Monitoring -- 22~26 July 2008
Measurement Location Outside Memorial Chapel On Chapel Drive Side



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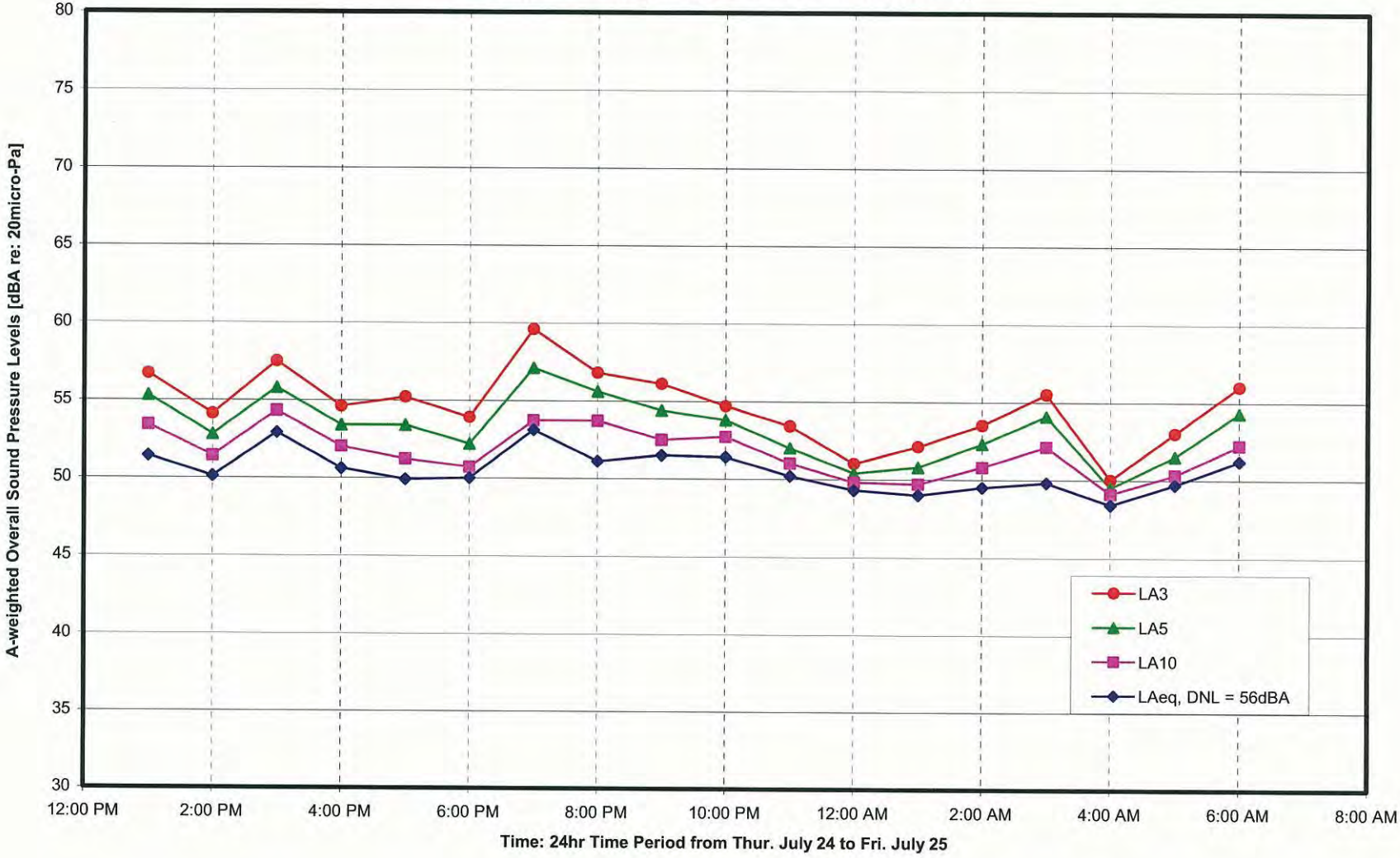
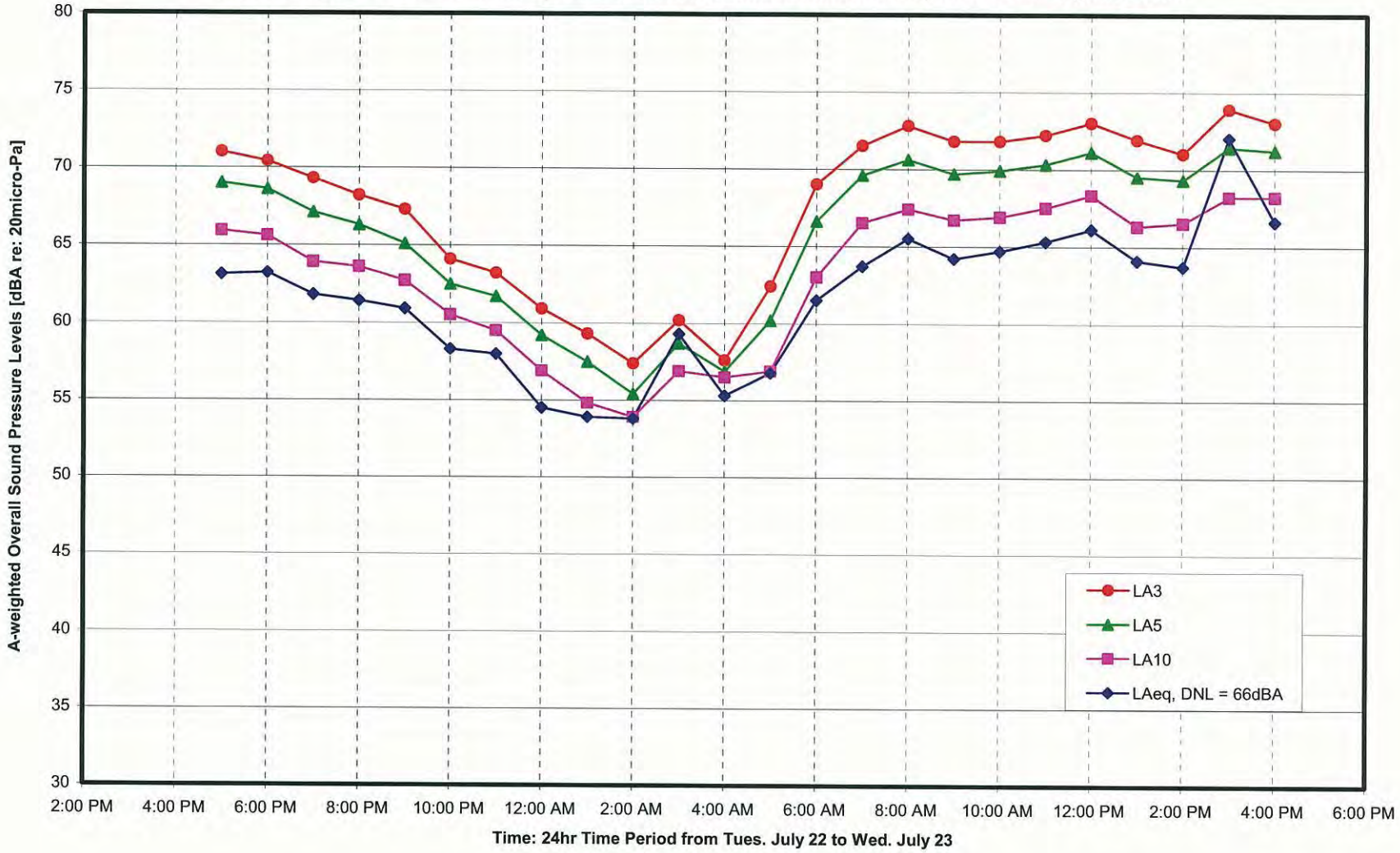
Appendix C: UMD 24-Hour Exterior Noise Monitoring -- 22~26 July 2008
Measurement Location Outside of Shoemaker Building



Appendix C: UMD 24-Hour Exterior Noise Monitoring -- 22~26 July 2008
Measurement Location Outside Symons Hall next to Intersection of Campus Drive & Regents Drive



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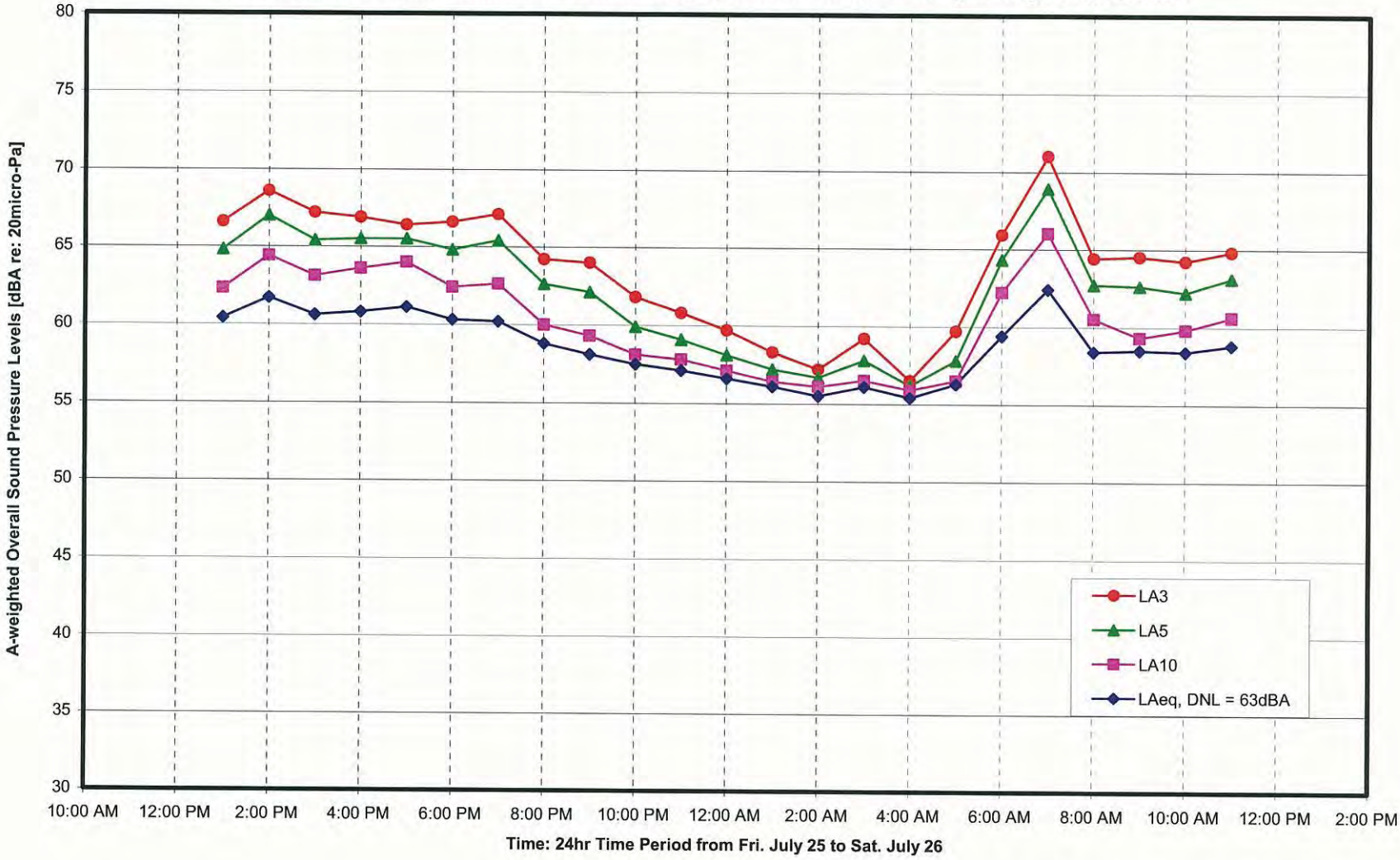
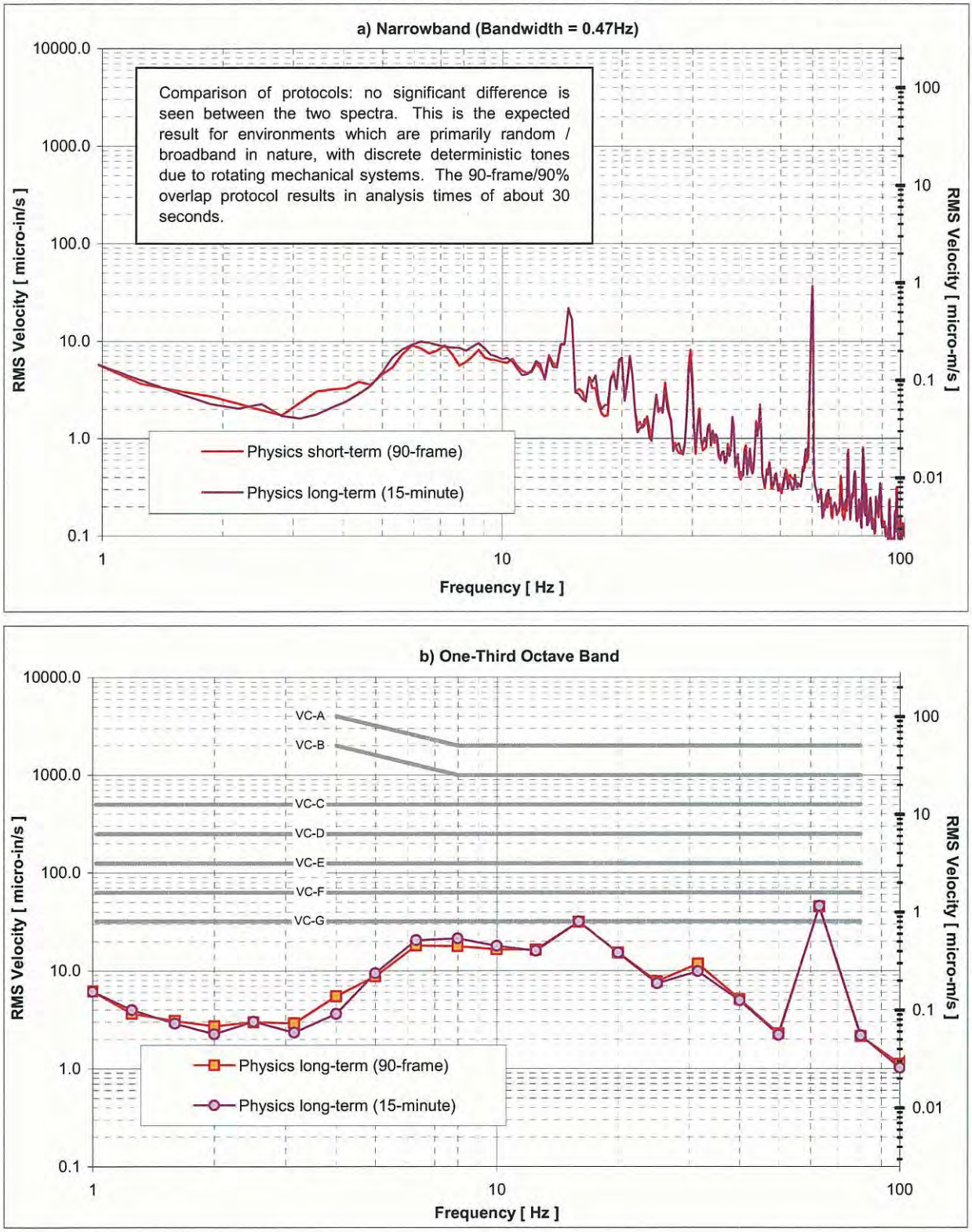
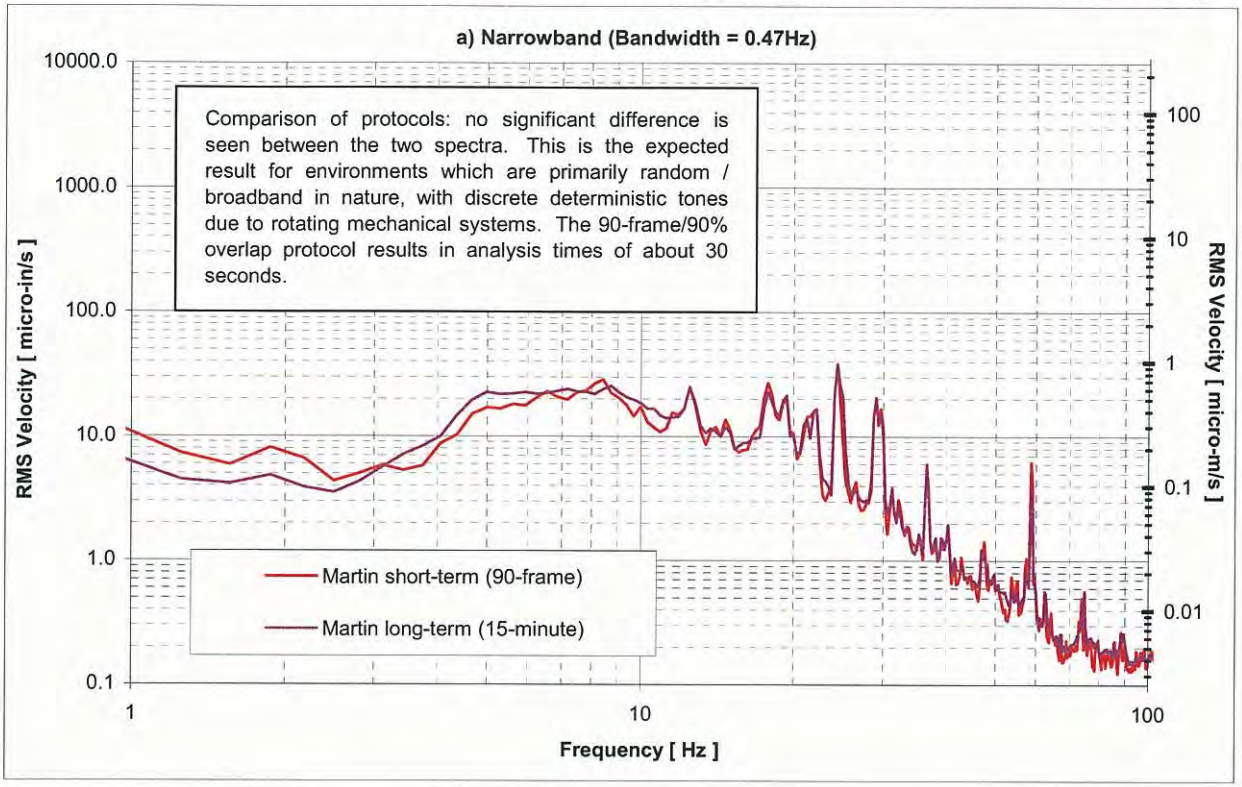
Appendix C: UMD 24-Hour Exterior Noise Monitoring -- 22~26 July 2008
Measurement Location Outside the Adele H. Stamp Student Union Building Facing Campus Drive

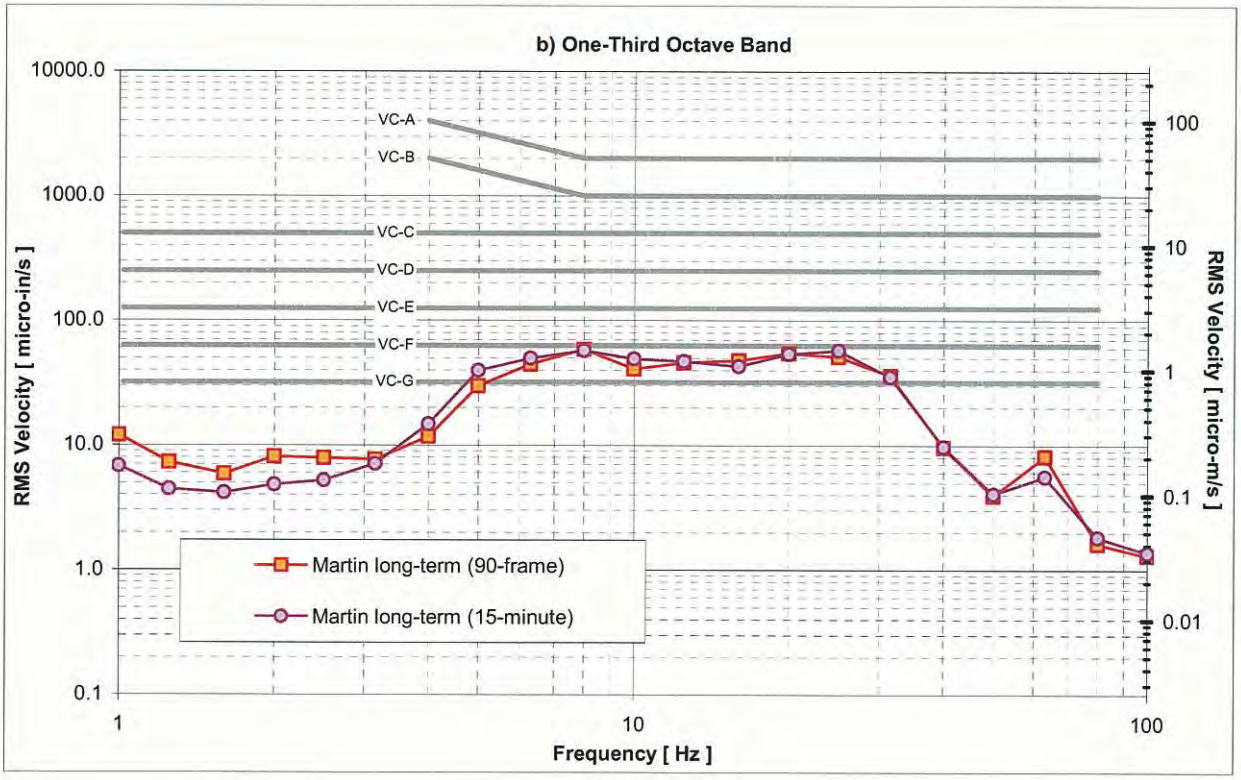


Appendix D: UMD Campus Vibration Survey / PROTOCOL COMPARATOR -- 22~25 July 2008
VACC protocol (linear agerage of 90 frames/90% overlap) vs. continuous 15-minute linear average



Appendix D: UMD Campus Vibration Survey / PROTOCOL COMPARATOR -- 22~25 July 2008
VACC protocol (linear agerage of 90 frames/90% overlap) vs. continuous 15-minute linear average





Executive Summary

We were asked to consult the University on matters regarding vibration and noise impact to research and other potentially-sensitive activities on campus. In this document, we report the results of calculations we made as an estimate of potential vibration impact on campus from the Purple Line.

Vibration impact on campus is primarily a function of two parameters: (1) the forces generated by the light rail vehicle (FDL); and (2) the way that the soils respond to those forces (LSR). The FDL is a property of the train system; the LSR is a property of the campus soils.

As of this writing, MTA has not selected a vehicle or track system for the Purple Line. Therefore, no explicit FDL data are available. The University asked us to use one set of FDL data from a published source and one set of independent data to generate example predictions.

We visited campus during the last week of August 2008 to collect transfer function data at UMD in order to compute LSRs. The testing methodology is based on the application of a known force and measuring the resulting ground motion at multiple distant setbacks. The computed LSRs behave as expected from theoretical considerations. At small setbacks, the curves generally rise with frequency. At high frequencies, the vibration propagation falls off rapidly with distance. A "pinch" in the curves around 10Hz implies particularly efficient propagation at this frequency.

In order to evaluate impact, we needed to know something about the existing condition as a basis of comparison. Previous work on campus demonstrated that the campus vibration environment is comparable to other research institutions and universities. The performance of newer or newly-retrofitted buildings would be comparable to the most stringent criteria used in academia and industry (NIST-A at low frequencies, and VC-F/G at higher frequencies).

In 2007, the VC-F and VC-G criteria were added to a criterion regime (published by IEST) in order to address the needs of current and the next generation of precision tools. The NIST-A criterion is being used for academic and institutional facilities, including the new Physical Sciences Complex (PSC) currently planned for construction on the UMD campus. Even "off-the-shelf" tools from established instrument makers like JEOL, Philips, FEI, and Applied Materials demand VC-F/G environments in some frequency ranges.

Given the NIST-A and VC-F/G environments on campus, the University asked us to develop predictions for setbacks required to meet these criteria. Based on the force data (FDLs) and ground propagation (LSR) data described in this report, we developed setbacks required to meet the NIST-A criterion and the VC-F criteria. **The Campus Drive Alignment requires 250' and 520' to meet the NIST-A and VC-G criteria, respectively. The Preinkert Drive Alignment requires 200' and 400' to meet these same criteria.** By chance, the same setback that meets the NIST-A criterion also meets the VC-F criterion.

The LSR data imply slightly more efficient propagation at all frequencies along the Campus Drive Alignment. Along both alignments, the performance at 10Hz controls the setback because of the more-efficient long-distance propagation at around this frequency and also because of higher forces from typical LRT systems at this frequency.

We have good confidence in the ground propagation (LSR) data. On the other hand, the force (FDL) data are taken from example systems rather than the real system that would be constructed. The real FDL for the system (vehicle + rail) selected by MTA might be higher or lower. Given that data from the high end of the FDL range were used, we suggest that it should be possible for MTA to develop a system that generates lower forces than assumed in this analysis.

Table of Contents

1. Background

The University of Maryland at College Park (UMD) is a major public research university, with enrollment of over 36,000 students. It is the largest university in Maryland and the Washington Metropolitan Area. Many members of the faculty receive funding and institutional support from government agencies such as the National Institutes of Health (NIH), the National Aeronautics and Space Administration (NASA) and the Department of Homeland Security (DHS). In addition, significant research relationships exist between faculty members and organizations such as the National Institutes of Standards and Technology (NIST).

The Maryland Transit Administration (MTA) has been working on a proposed new transit line (the Purple Line) to offer better transportation options in Montgomery and Prince George's Counties. According to the MTA website, "[t]he Purple Line is a proposed 16-mile rapid transit line extending from Bethesda in Montgomery County to New Carrollton in Prince George's County. It will provide a direct connection to the Metrorail Red, Green and Orange Lines; at Bethesda, Silver Spring, College Park, and New Carrollton." As we understand it, the Purple Line would be an electrified surface light rail transit (LRT) system.

The proposed alignment for the Purple Line would pass through the UMD campus. Like any rail system, the Purple Line would introduce ground vibration, acoustical noise, and electromagnetic pollutants to the environment. We were asked to consult the University on matters regarding vibration and noise impact to research and other potentially-sensitive activities on campus. The electromagnetic issue is being addressed by others.

We previously performed field testing to define the existing ambient vibration environment on campus. Those data were transmitted in a formal report dated 14 October 2008. In this document, we report the results of calculations we made as an estimate of potential vibration impact on campus from the Purple Line. The estimates are presented for two potential alignments: a Campus Drive Alignment and a Preinkert Drive Alignment.

2. LRT Vibration Impact Basic Theory

Vibration impact on campus is primarily a function of two parameters: (1) the forces generated by the light rail vehicle; and (2) the way that the soils respond to those forces. Both parameters vary with frequency; in the case of the UMD campus, we are interested in performance between about 5Hz and 100Hz.

The force parameter is called the "force density level" or FDL. This is a spectrum of dynamic force generated by the vehicle. It is a function of the LRT vehicle and rail support. Items affecting the FDL for a system include vehicle mass, speed, primary suspension frequency, wheel trueness, rail straightness, rail corrugation, and rail fixture stiffness among others. It is important to note that the FDL is a property of the train system and is affected only by parameters under the control of the MTA design team.

The vibration transmissibility parameter is called the "line source response" or LSR. This is a spectrum that describes how a force applied along a line of a given length at one location gets translated into motion at an arbitrary distant location. It is a type of transfer function. An LSR is computed for each train length and receiver setback. It depends on soil properties such as stiffness and damping; in addition, the geometries and locations different deep soil layers affect long-distance propagation. For a campus the size of UMD, the LSR might be different from location to location simply due to differences in soils. It is important to note that the LSR is a property of the campus

soils. For our purposes here, the LSR is fixed since the soils' dynamic behavior cannot be significantly modified.

When expressed in decibels referenced to the appropriate units, the vibration levels resulting from LRT operation may be calculated by the expression,

$$V(f) = FDL(f) + LSR(f)$$

where

V is the vibration velocity in decibels referenced to 1 micro-inch/sec

FDL is the force density level in decibels referenced to 1 LBF/ft$^{1/2}$

LSR is the line source response in decibels referenced to 1 micro-inch/second per LBF/ft$^{1/2}$

This approach is discussed in detail in the Federal Transit Administration (FTA) guidance manual.[1]

2.1 Force Density Levels

As of this writing, MTA has not selected a vehicle for the Purple Line. Therefore, no explicit FDL data are available. However, some known quantities exist. We are told that the trains are expected to be 160 feet long and operate at 15mph on campus. The 15mph assumption appears reasonable given the current speed of traffic and density of pedestrians around the proposed alignments.

While no FDL data will be available for the Purple Line until a vehicle and track system are chosen, ranges of published data exist from a guidance manual published by the Federal Transit Authority (FTA). In addition, we have access to a few measurements from other projects. While considerable variety exists in track support and vehicle parameters, we believe that these example data provide a reasonable range of possibilities in FDL.

The University asked us to use one set of FDL data from the FTA manual and one set of real-world system data to generate a set of example predictions. The FTA spectrum used in the calculations was the upper bound of a data set comprised of measurements of multiple systems. The "real-world" spectrum we used were data from an operating system in San Jose, California.[2] The two spectra were very close in the controlling frequency range; therefore, the calculations returned similar results regardless of which FDL is used.

2.2 Line Source Responses

We visited campus during the last week of August 2008 to collect transfer function data at UMD. We tested at four campus locations to adequately capture the natural variability in the soils. Two of

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[1] **Transit Noise and Vibration Impact Assessment**, U. S. Department of Transportation, Federal Transit Administration, FTA-VA-90-1003-06, May 2006.

[2] See Figure 11-2 of the FTA manual. The FTA data set were published for light rail vehicles at 40mph; the "real-world" data set was collected at 20mph. Both spectra were scaled to 15mph based on an energy argument that the vibration level scales as the square of the train speed.

these locations were along the Campus Drive Alignment; the other two were along the Preinkert Drive Alignment. The test locations included:

Test Series A: Along Regents Drive north from Campus Drive
Test Series B: Union Lane north from Campus Drive
Test Series C: Not used
Test Series D: Along the alley between Lefrak Hall and SCUB 2 towards Preinkert Drive
Test Series E: Along Chapel Drive from Marie Mount Hall west along Skinner Hall

The test locations and alignment options are indicated in Figure 1 (overview) and Figure 2 (detail).

The testing methodology is based on the application of a known force and measuring the resulting ground motion. We performed testing overnight during traffic stoppages to minimize interference from background vibration sources. The instrumentation included a 200-lb instrumented drop hammer and seven distant receivers at setbacks ranging from 25' to 450'. The drop hammer and parts of the receiver array are shown in the photos in Figure 3.

We tested at one location per night, gathering data for 40~80 impact events per test location. Time history data were recorded for analysis in our offices. We developed a set of Matlab scripts to handle the extensive post-processing effort required for such an enormous data set.

We developed "point source response" (PSR) spectra from the hammer test data. The PSRs were computed independently for the Campus Drive Alignment and for the Preinkert Drive Alignment. From the family of curves at the two testing locations per alignment, we conservatively selected the higher of the two results, giving the higher vibration propagation. A regression was performed for each frequency to arrive at an expression of PSR as a function of distance. This regression was based on the logarithm of the setback. A quadratic provided the best agreement with the data over the range of setbacks of interest here.[3]

Since the testing used a point source (the drop hammer), a correction must be applied to account for the behavior exhibited by the LRT vehicle, which acts like a line source rather than a point source. For each train length and setback, the LSR is computed by integrating the PSRs along the length of the train. This properly accounts for the fact that for receivers at short setback, the train is not at a single setback (at mid-passage, the ends of the train are much farther away than is the center of the train).

Figure 4 illustrates an example family of LSR curves. A table above the plot gives the PSR regression terms for each frequency band. The LSR integral for eight example setbacks ranging from 12' to 800' is computed in the bottom portion of the table; those data are plotted graphically, as well. Below the plot, the PSR-to-LSR integration is explained.

The family of curves in Figure 4 behaves as expected from theoretical considerations. At small setbacks, the curves generally rise with frequency. At high frequencies, the vibration propagation falls off rapidly with distance. The "pinch" in the curves around 10Hz implies particularly efficient propagation at this frequency. This is consistent with some ambient data that seemed to suggest the presence of a soil resonance near 8~10Hz.

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[3] The behavior at far distances (beyond perhaps 80 or 100 feet) is expected to scale with the logarithm of the setback. However, a linear regression in log-log space (decibels vs. log distance) fails to account for the behavior at closer setbacks. While the quadratic fails to perform well at very large setbacks (beyond perhaps 800 or 1000 feet), it does a better job of capturing the true behavior over a range of setbacks spanning the transition between "near" and "far".

The reduced PSR data used in the development of the LSRs are shown in Appendix B.

3. Existing Condition and Industry Criteria

The University asked us to generate predictions for potential vibration impact due to the Purple Line. In order to evaluate impact, we needed to know something about the existing condition as a basis of comparison. Using criteria from industry and academia, we previously characterized environments on the UMD campus.

3.1 Criteria from Industry and Academia

Since the 1980s, advanced technology facilities and research and development environments have been characterized and designed to Generic Vibration Criterion curves as documented in IEST Report IES-RP-CC-12.1, "Considerations in Clean Room Design". This family of curves defines constant velocity vibration amplitudes as a function of frequency that apply to different vibration sensitivity categories. The curves may be seen in Figure 6, along with another criterion discussed below; a more comprehensive figure and discussion excerpted from the IEST report is contained in Appendix A. Despite the fact that this criterion regime was originally developed for cleanroom-based manufacturing facilities, it has found wide circulation in other industries and institutional settings in the US and around the world.

Until recently, the focus of the VC curves was for cleanrooms in industrial settings (especially for semiconductor manufacturing). At that time, the lowest curve (VC-E, or 125 micro-inches/sec) was considered to be near the lower limit of practical criteria.[4]

However, research and development environments, including university settings, are usually non-cleanroom spaces. Consequently, these environments are spared from the very high density of mechanical systems needed to operate a cleanroom, and suspended structures are typically not required. In general, university research spaces (at the ground level) can enjoy extremely quite vibration settings. Therefore, it has long been understood that environments quieter than VC-E exist.

Most industrial facilities have successfully been designed and operated to these VC curves while the manufacturing feature size has shrunk to deep submicron length scales. However, for many years, the engineering community has recognized that R&D facilities, particularly research settings in universities and national labs, may demand tighter limits as many experimental tools developed by professors and researchers are one-of-a-kind and not considered "mature" tools. The vendors of mature, "off-the-shelf" tools have invested considerable resources into the engineering of robustness against environmental contaminants like vibration. For one-of-a-kind tools and hand-built experiments by researchers, this level of investment is unattainable, therefore creating a need for even quieter spaces.

In one such unique application, the National Institute of Standards and Technology (NIST) was in the process of developing a tool which required a floating slab construction. A concrete slab was placed on air springs in order to reduce the ambient vibration experienced by the tool. The actual

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[4] The Federal Transit Administration guideline manual discusses this VC-E curve as the "most demanding criterion for extremely vibration-sensitive equipment" in Table 8-8.

performance of the floating slab became the basis for the development of the criterion curve now known as "NIST-A". This curve is a bit different from the constant velocity VC curves. In the low frequency region, the NIST-A curve demands a tighter vibration control due to the resonance amplification of the air springs. As can be seen in Figure 6, the curve becomes the same as VC-E at frequencies above 20Hz. Therefore, NIST-A is more relaxed than VC-F and VC-G at higher frequencies.

In addition to the challenges presented by one-of-a-kind tools, a new generation of high precision tools has recently been developed capable of imaging and inspection at nanometer length scales. It should be noted that as the precision level increases targeting ever smaller feature sizes, the demand on the environment increases as well.

In response to the dual challenges of one-off experiments and the new generation of nanotechnology tools, two new curves called VC-F and VC-G have been adopted. In 2007, these new criteria were incorporated into the above-mentioned IEST report in order to address the needs of the current as well as the next generation of precision tools. In addition, the NIST-A criterion is being used in more and more facilities. A new facility currently under design for Brookhaven National Labs calls for the NIST-A criterion, as does the new Physical Sciences Complex (PSC) currently planned for construction on the UMD campus. It is our opinion that VC-F and VC-G curves, which apply to non-floating slab conditions present in most university ground/basement level slabs, are generally more appropriate to use, perhaps with the concession that exceedances at high frequencies (above 20Hz) are potentially less problematic than exceedances at low frequencies.

A few examples of tools requiring VC-F and VC-G environments include:

- FEI Technai G2 20 Super Twin TEM (Requires VC-G)
- FEI FIB-1265 (Expida) Focused Ion Beam (Requires VC-F)
- JEOL JEM 2100/2100F SEM (Requires VC-F)
- Philips 400 SEM (Requires VC-G)
- Applied Materials VeraSEM / NanoSEM 3D (Requires VC-F)

Because the criteria for most of these tools become more relaxed at higher frequencies, many are also able to accommodate a NIST-A environment. These tools (and others like them) are used across disciplines from medical and biological research to the physical sciences to engineering fields. It is informative to note that these are mature tools from established vendors with long histories of experience with precision instruments.

3.2 Existing Ambient Vibration Environment

We previously performed on-campus measurements of the ambient vibration environment at UMD. As expected, those tests revealed a range of performance. Some buildings have higher or lower vibration environments simply due to proximity of nearby roads or the performance of base-building mechanical systems such as fans and pumps. A statistical summary of the existing ambient condition from 16 buildings is given in Figure 5. In addition, data from two western parking lots are given in Figure 6.

Vibration levels in Parking Lots 1B and 1D mimic the expected behavior of the true "environmental" contribution to the building vibration environments.[5] Overall, the campus vibration environment is comparable to other research institutions and universities. The "average" ambient environment shown in Figure 5 meets the "NIST-A" criterion. The true environmental contribution as inferred from the data in Figure 6 implies the possibility of even quieter spaces. In the absence of poorly-isolated local sources (mainly mechanical equipment inside the buildings), the performance of many new or retrofitted buildings would be comparable to the most stringent criteria used in academia and industry (NIST-A at low frequencies, and VC-F/G at higher frequencies).

4. Setbacks to Meet Campus Criteria

Given the NIST-A and VC-F/G environments on campus, the University asked us to develop predictions for setbacks required to meet these criteria. Based on the force data (FDLs) and ground propagation (LSR) data described above, we developed setbacks required to meet the NIST-A criterion and the VC-F criteria. Plots of the predicted vibration velocity are shown in Figures 7~10. Campus maps illustrating the setbacks are shown in Figures 11 and 12. We make the following comments:

- Figures 7 and 8 illustrate the predicted response for the Campus Drive Alignment and Preinkert Drive Alignment. At 250' and 200' setback (respectively), both the NIST-A and VC-F criteria are met.
- As shown in the plots, the NIST-A and VC-F criteria cross at 10Hz. By coincidence, this is also the frequency that controls. Therefore, we can say that both criteria are met for the setbacks shown in Figures 7 and 8.
- Figures 9 and 10 illustrate the predicted response at 520' and 400' setbacks. At these larger distances, the more stringent VC-G criterion is met.
- As with the predictions at shorter setbacks, the performance is controlled by vibration at lower frequencies, especially near 10Hz.
- The fact that the performance at 10Hz controls the setback is due to both more-efficient long-distance propagation at around this frequency and due to higher forces from typical LRT systems at this frequency, as well.
- We based the setback recommendations on the performance at 10Hz, since this seems to be the band in which the soil transmits vibrations most efficiently. The small exceedances at 16Hz and 20Hz (seen in Figures 7~9) should not be taken too seriously.

In addition to the above comments specific to the individual plots, we also have several general comments on the propagation test results and predicted performance:

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[5] In Figure 6, note that the parking lot data fall in the middle of the range in the low-frequency regime, and lie at the low end of the range in the high-frequency regime. This is exactly the relationship that would be expected if, for the buildings, low-frequency performance were dominated by environmental sources while high-frequency performance was dominated by local sources.

- The LSR data imply slightly more efficient propagation at all frequencies along the Campus Drive Alignment. Data from Test Series A (near the Physics Building) had the highest calculated propagation. This is the reason for the larger required setbacks for the Campus Drive Alignment.
- The predicted setback requirements are practically the same regardless of whether we consider force (FDL) data from the FTA manual or from the "real-world" VTA system. This is because the FDLs for these two sources are nearly the same in the controlling frequency bands.
- We have good confidence in the ground propagation (LSR) data. Further analyses might result in minor adjustments to the LSRs, but we expect no major revelations. On the other hand, the force (FDL) data are taken from example systems rather than the real system that would be constructed. The real FDL for the system (vehicle + rail) selected by MTA might be higher or lower. We have conservatively used FDLs from the top end of the range of available data in order to minimize the chance that the installed system would require greater setbacks than those illustrated in Figures 12 and 13.
- Aside from the FDL, several other forms of uncertainty exist in these data. For example, the predictions are only for a single train passing at a time; occasionally, two trains will pass simultaneously. On the other hand, it is likely that the trains will not be able to maintain 15mph continuously, especially on the curvy and crowded Preinkert Drive Alignment. We expect that these and other uncertainties are generally within the overall range of FDL data that are available. For example, the FTA minimum-to-maximum range is about 14dB at 10Hz.
- Given that data from the high end of the FDL range were used, we suggest that it should be possible for MTA to develop a system that generates lower forces than assumed in this analysis. Therefore, we believe that there is a good chance that the required setbacks could be reduced if attention is paid to system FDL. As noted above, there is a substantial range of 14dB in the important 10Hz frequency band. At most other frequencies, the minimum-to-maximum range reported by FTA is 10dB or greater.

• • •

This concludes our report. Please feel free to call if you have any questions. We may be reached in our offices by telephone at (+1) 415-693-0424 or via email at byron@va-consult.com.

Sincerely,

Byron Davis
Vibro-Acoustic Consultants

Figure 1: University of Maryland / Purple Line – December 2008
Campus map, with alignment options shown

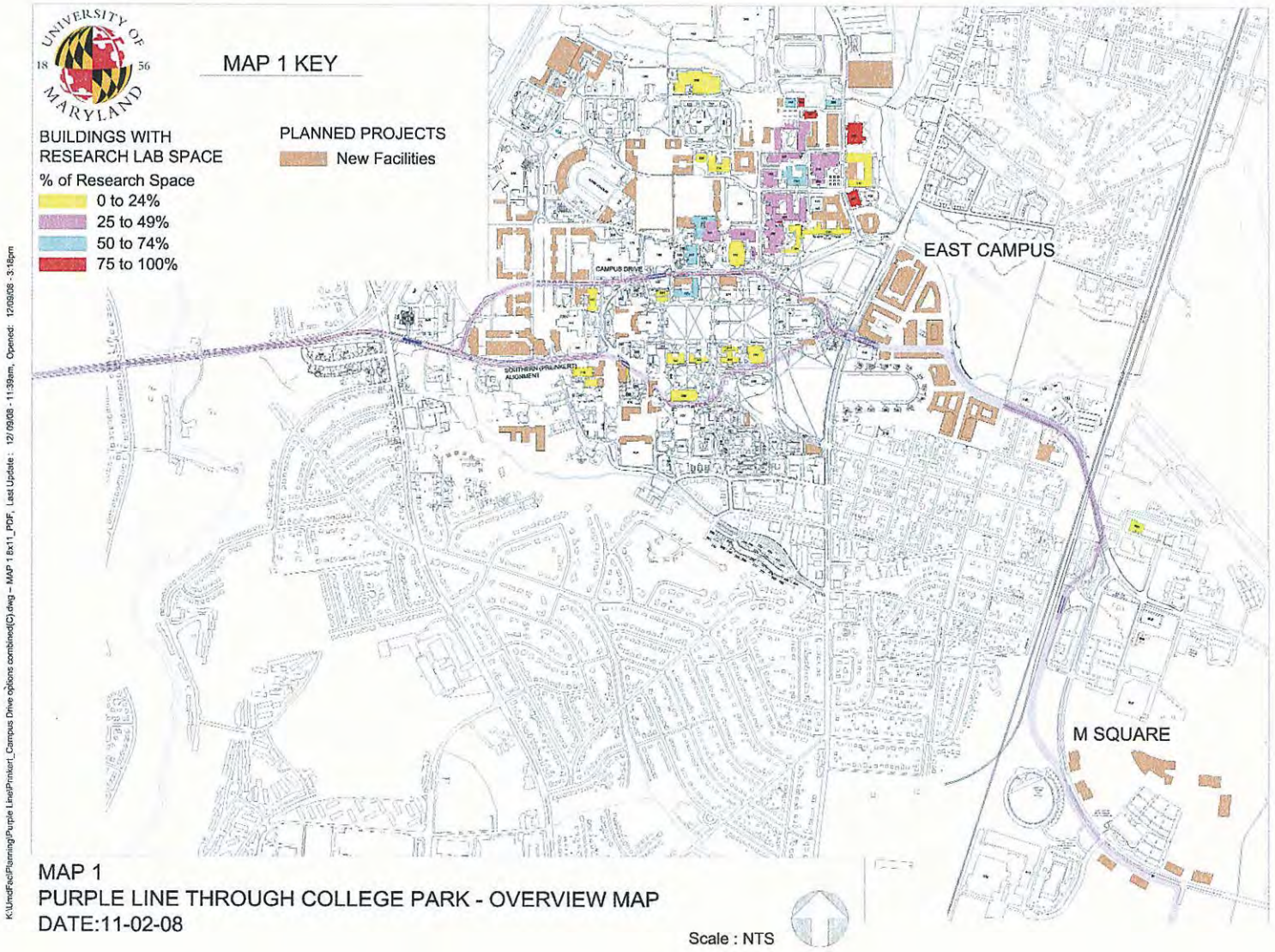


Figure 2: University of Maryland / Purple Line – December 2008
Campus map detail, with field testing locations indicated

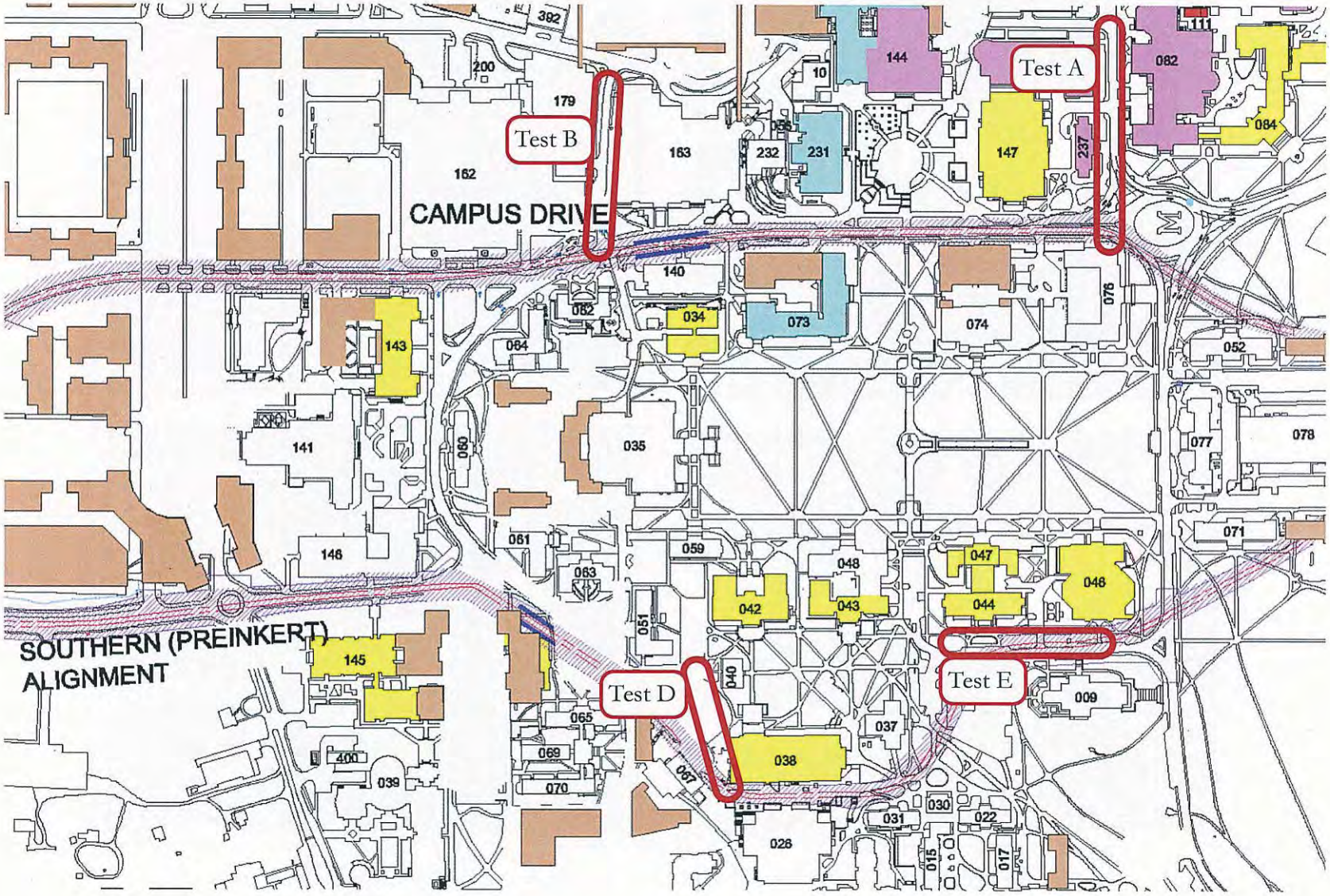


Figure 3: University of Maryland / Purple Line – December 2008
Photos of instrumentation used during field testing to develop line source response (LSR) data

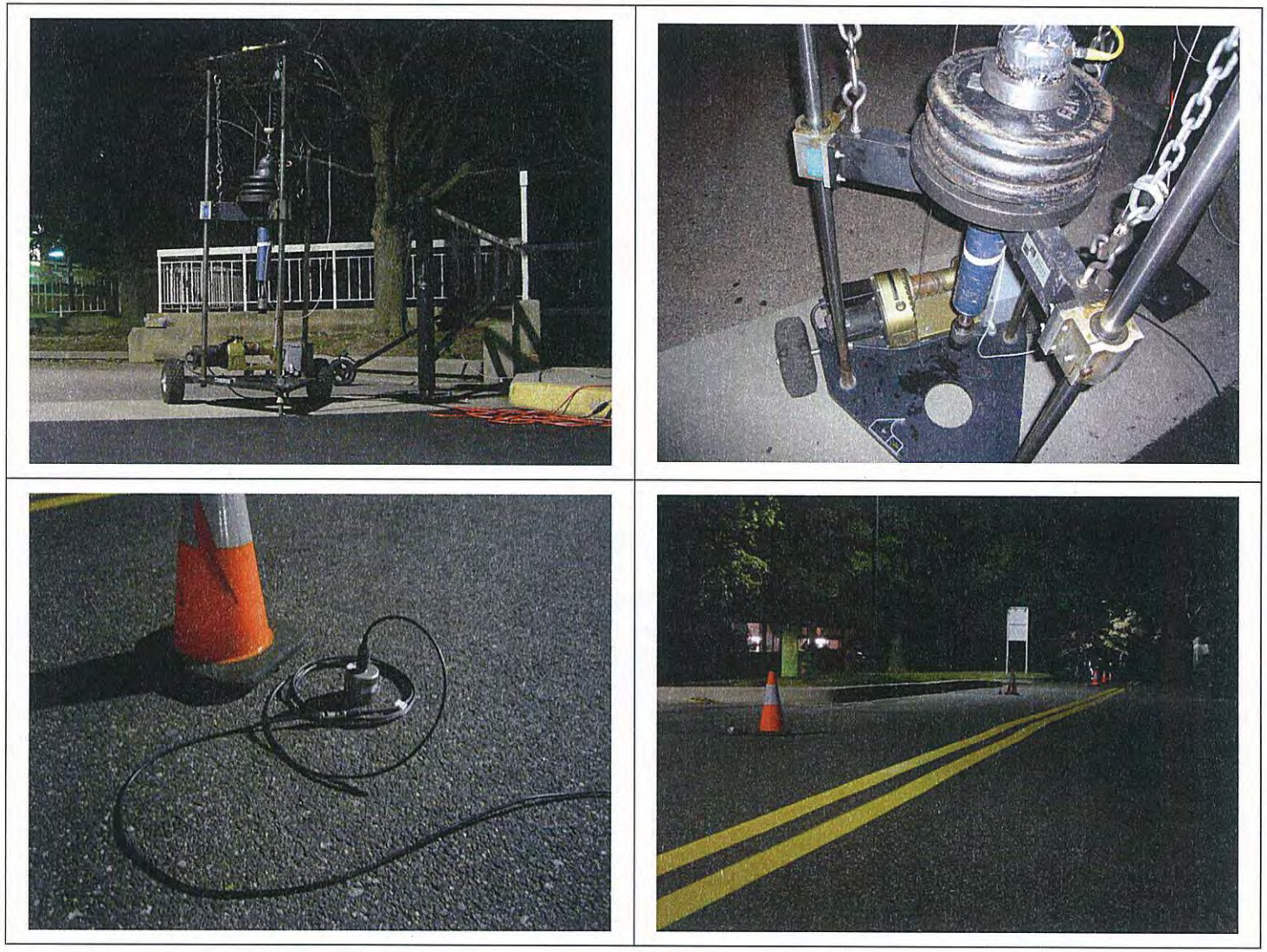
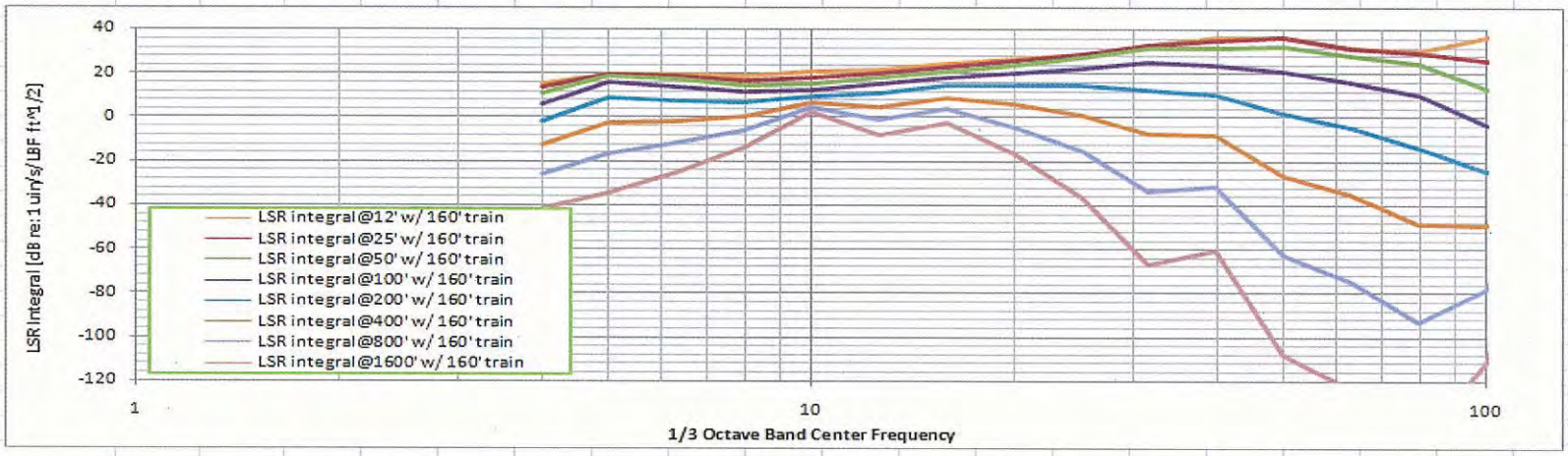


Figure 4: University of Maryland / Purple Line – December 2008
Example LSR data for the Campus Drive Alignment, based on field test data

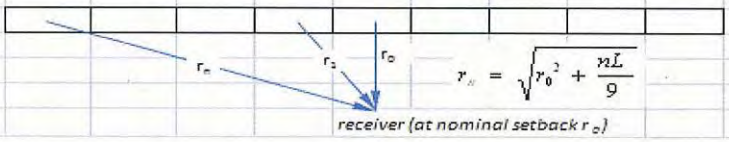
Building: (arbitrary)
Setback: (see below)
Train Length: 160

Notes: The PSR for a given setback r is based on a quadratic regression $PSR_r = A(\log r)^2 + B(\log r) + C$
There is a "range justification" for doing the regression in Log-Log space. A better regression might be possible.

	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126	
Campus Drive PSR r^2 term	-13.0	-19.9	-11.9	-4.9	-8.6	-4.3	-2.8	-11.0	-21.3	-35.9	-26.4	-44.8	-50.0	-53.9	-19.3	31.8	
Campus Drive PSR r^1 term	27.4	61.0	29.4	3.9	25.2	2.4	-2.6	25.8	61.3	109.4	66.8	124.4	142.6	147.8	9.1	-174.6	
Campus Drive PSR r^0 term	-18.3	-48.4	-18.8	1.5	-24.5	5.7	12.9	-8.5	-36.1	-70.7	-25.0	-68.7	-88.9	-89.8	35.9	191.1	
LSR integral@12' w/ 160' train	15	19	20	18	21	22	25	27	29	33	36	37	32	30	37	52	[dB]
LSR integral@25' w/ 160' train	14	20	19	17	18	20	23	26	29	33	36	37	32	30	26	23	[dB]
LSR integral@50' w/ 160' train	11	19	17	15	16	18	21	24	27	32	32	32	28	24	13	4	[dB]
LSR integral@100' w/ 160' train	6	16	14	11	13	15	18	20	22	25	24	21	16	10	-3	-10	[dB]
LSR integral@200' w/ 160' train	-2	9	7	7	10	10	14	14	14	12	10	2	-5	-14	-24	-20	[dB]
LSR integral@400' w/ 160' train	-13	-2	-1	1	7	5	9	6	1	-8	-8	-26	-35	-48	-49	-26	[dB]
LSR integral@800' w/ 160' train	-26	-17	-12	-6	4	-1	4	-5	-16	-34	-32	-63	-75	-93	-78	-25	[dB]
LSR integral@1600' w/ 160' train	-41	-35	-25	-14	2	-8	-2	-17	-36	-67	-60	-108	-124	-147	-111	-19	[dB]



Since for close receivers the train is not at a single setback, we have to integrate along the length of the train. We use a 9-segment train, each segment of length L/9.



The integral becomes a summation of the force from each segment of length L/9. The force from each segment travels through a different setback. Since the geometry is symmetrical around r_0, we only have to calculate half of the terms. In linear terms, the LSR looks like:

$$LSR^2 = PSR_{r_0}^2 \cdot \frac{L}{9} + 2\sum_{n=1}^{4} PSR_{r_n}^2 \cdot \frac{L}{9}$$

In decibels, we take 20log(LSR); the units are dB re: 1uin/sec/LBF $ft^{1/2}$

Figure 5: University of Maryland / Purple Line – December 2008
Statistical summary of building ambient vibration for 16 research-oriented buildings across UMD campus

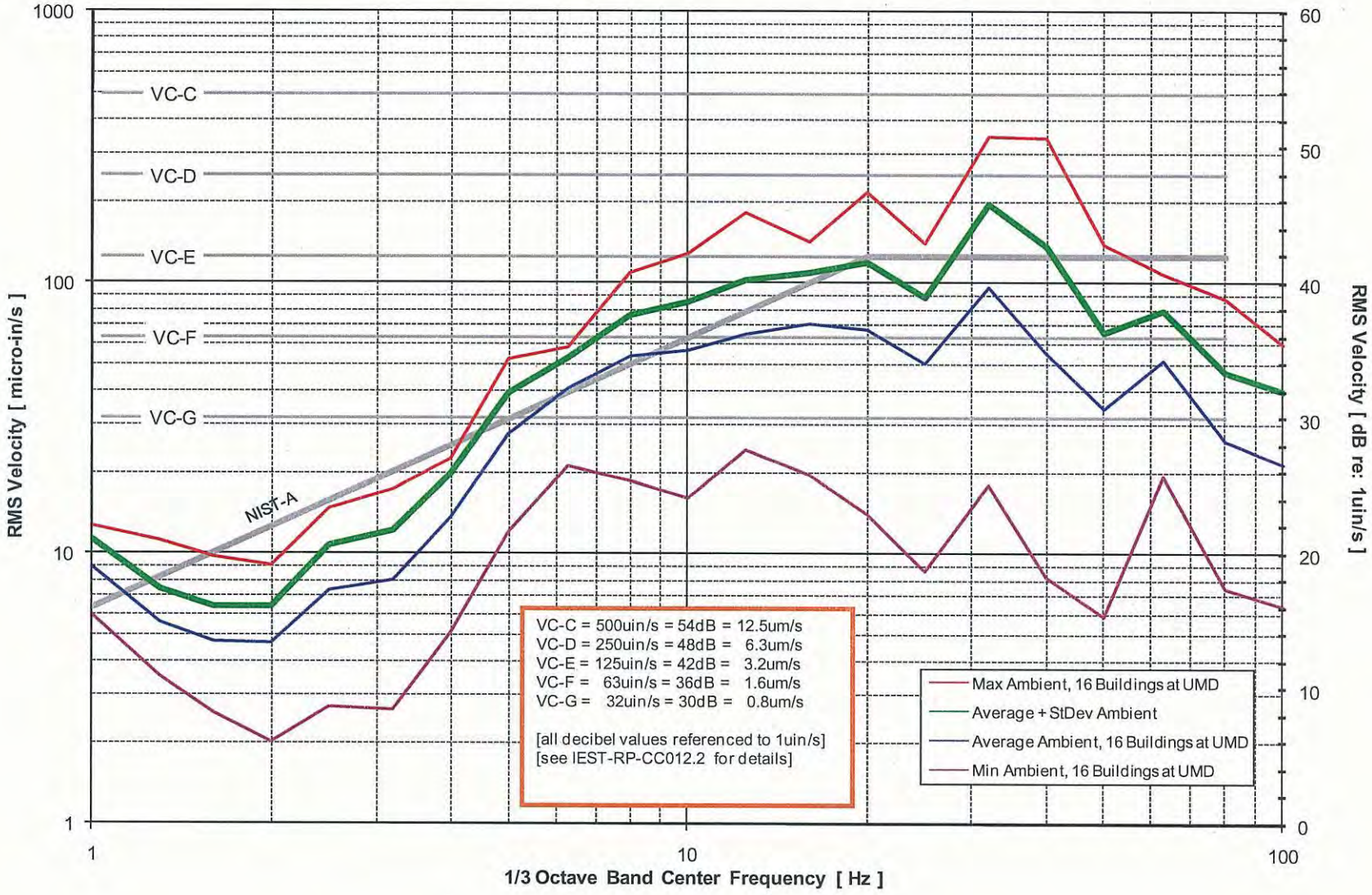


Figure 6: University of Maryland / Purple Line – December 2008
Comparison of ambient vibration: Parking Lots 1B, 1D vs. range of 16 research-oriented buildings across UMD campus

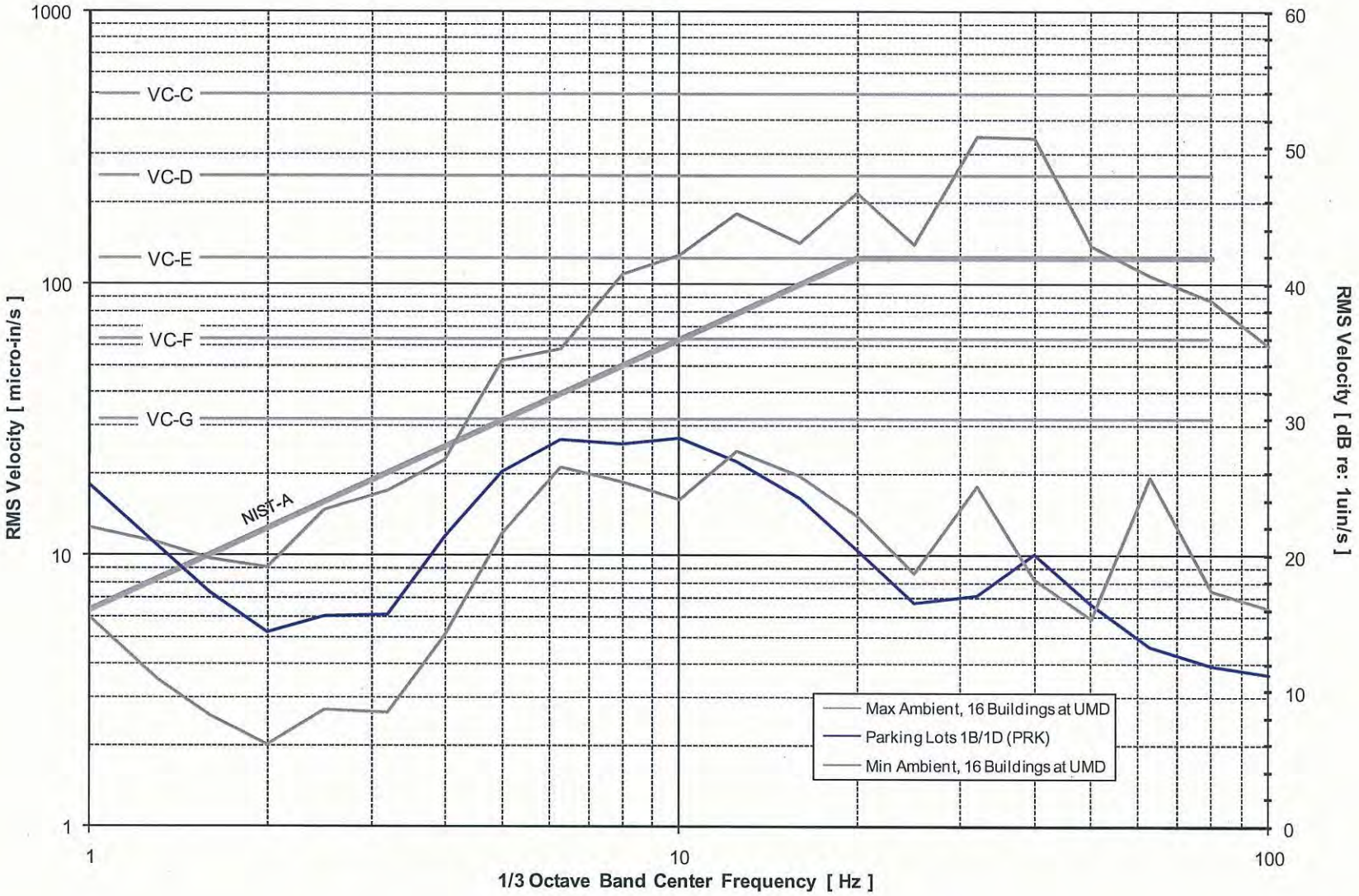


Figure 7: University of Maryland / Purple Line – December 2008
Predicted vibration velocity spectrum along Campus Drive Alternative, meeting NIST-A / VC-F at 250' setback

Building: <ARBITRARY>
Setback: 250 (Campus Drive Al't)
Train Length: 160

Note: PSR terms based on quadratic regression of mobility [dB] vs. log distance [ft]; LSR integral uses 9-segments.
Velocity prediction based on v[dB] = FDL + LSR; velocities presented in linear terms for convenience.
A reported velocity of "0" in the table is not really zero; figures are rounded to the nearest whole number.

	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126	
Campus Drive PSR r^2 term	-13.0	-19.9	-11.9	-4.9	-8.6	-4.3	-2.8	-11.0	-21.3	-35.9	-26.4	-44.8	-50.0	-53.9	-19.3	31.8	[dB]
Campus Drive PSR r^1 term	27.4	61.0	29.4	3.9	25.2	2.4	-2.6	25.8	61.3	109.4	66.8	124.4	142.6	147.8	9.1	-174.6	[dB]
Campus Drive PSR r^0 term	-18.3	-48.4	-18.8	1.5	-24.5	5.7	12.9	-8.5	-36.1	-70.7	-25.0	-68.7	-88.9	-89.8	35.9	191.1	[dB]
LSR integral@250ft	-5.1	5.6	4.8	4.9	8.4	8.8	12.4	11.8	10.3	6.6	4.9	-6.5	-13.3	-24.0	-31.8	-22.5	[dB]
FDL, FTA [max scaled to 15mph]			19	23	26	22	23	24	17	15	12	15	19	22	21	14	[dB]
FDL, VTA data [scaled to 15mph]			17	22	28	20	21	20	19	21	25	29	32	35	32	29	[dB]
Predicted velocity, based on FDL from FTA			16	26	56	37	62	65	24	13	7	3	2	1	0	0	[uin/s]
Predicted velocity, based on FDL from VTA			12	21	63	26	44	37	27	23	29	13	8	3	1	2	[uin/s]
NIST-A	25	32	40	50	63	80	100	125	125	125	125	125	125	125	125		[uin/s]

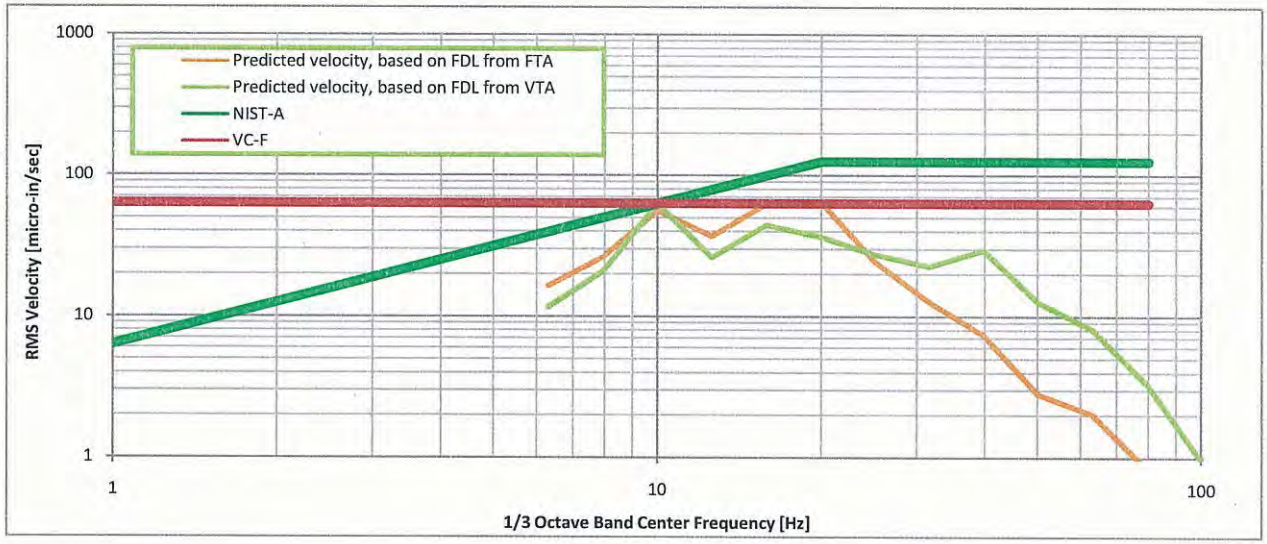


Figure 8: University of Maryland / Purple Line – December 2008
Predicted vibration velocity spectrum along Preinkert Drive Alternative, meeting NIST-A / VC-F at 200' setback

Building: <ARBITRARY>
Setback: 200 (Preinkert Drive Al't)
Train Length: 160

Note: PSR terms based on quadratic regression of mobility [dB] vs. log distance [ft]; LSR integral uses 9-segments.
Velocity prediction based on v[dB] = FDL + LSR; velocities presented in linear terms for convenience.
A reported velocity of "0" in the table is not really zero; figures are rounded to the nearest whole number.

	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126	
Preinkert Drive PSR r^2 term	-5.5	-23.3	-6.9	3.1	-4.2	-5.9	-12.3	-31.6	-40.3	-38.9	-34.1	-35.2	-13.9	-10.0	-15.1	6.8	[dB]
Preinkert Drive PSR r^1 term	4.3	68.6	7.8	-30.4	-0.3	4.2	28.4	101.5	126.6	118.1	97.9	93.8	14.2	-1.1	15.0	-69.5	[dB]
Preinkert Drive PSR r^0 term	-7.0	-59.4	-2.2	35.8	9.8	8.2	-12.2	-73.9	-87.8	-76.6	-58.8	-51.9	18.4	30.6	13.7	86.8	[dB]
LSR integral@200ft	-4.6	-3.2	1.2	4.3	8.7	8.5	9.9	13.7	11.4	10.6	7.3	-1.3	-1.1	-3.2	-10.5	-15.2	[dB]
FDL, FTA [max scaled to 15mph]			19	23	26	22	23	24	17	15	12	15	19	22	21	14	[dB]
FDL, VTA data [scaled to 15mph]			17	22	28	20	21	20	19	21	25	29	32	35	32	29	[dB]
Predicted velocity, based on FDL from FTA			11	24	58	35	47	81	28	20	10	5	8	9	4	1	[uin/s]
Predicted velocity, based on FDL from VTA			8	19	65	25	33	46	31	36	39	23	33	37	11	5	[uin/s]
NIST-A	25	32	40	50	63	80	100	125	125	125	125	125	125	125	125		[uin/s]

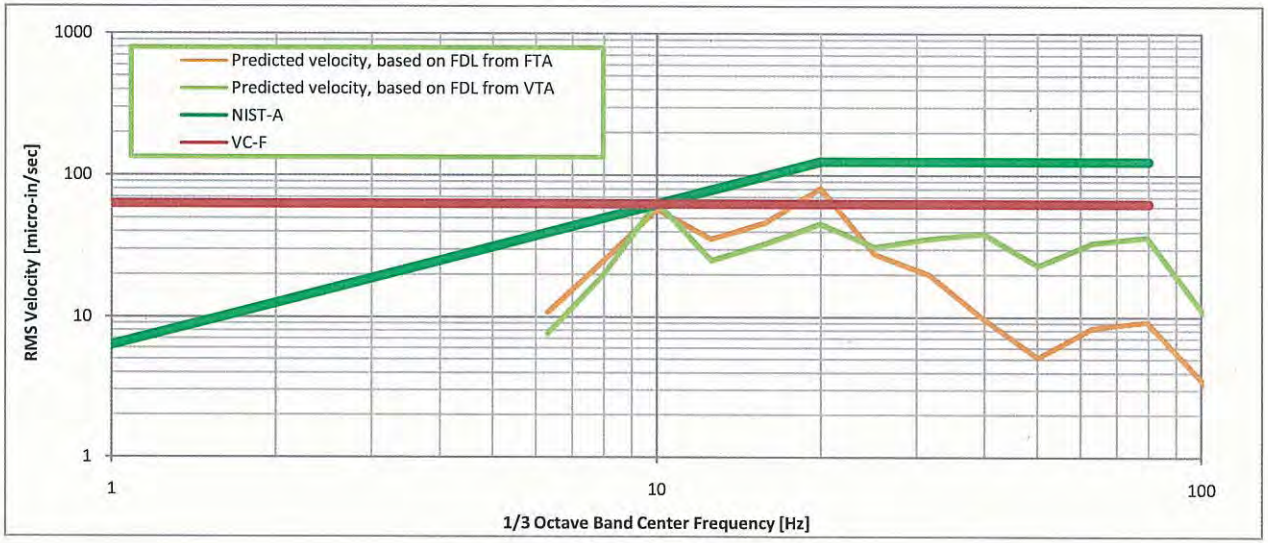


Figure 9: University of Maryland / Purple Line – December 2008
Predicted vibration velocity spectrum along Campus Drive Alternative, meeting VC-G at 520' setback

Building: <ARBITRARY>
Setback: 520 (Campus Drive Al't)
Train Length: 160

Note: PSR terms based on quadratic regression of mobility [dB] vs. log distance [ft]; LSR integral uses 9-segments.
Velocity prediction based on v[dB] = FDL + LSR; velocities presented in linear terms for convenience.
A reported velocity of "0" in the table is not really zero; figures are rounded to the nearest whole number.

	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126	
Campus Drive PSR r^2 term	-13.0	-19.9	-11.9	-4.9	-8.6	-4.3	-2.8	-11.0	-21.3	-35.9	-26.4	-44.8	-50.0	-53.9	-19.3	31.8	[dB]
Campus Drive PSR r^1 term	27.4	61.0	29.4	3.9	25.2	2.4	-2.6	25.8	61.3	109.4	66.8	124.4	142.6	147.8	9.1	-174.6	[dB]
Campus Drive PSR r^0 term	-18.3	-48.4	-18.8	1.5	-24.5	5.7	12.9	-8.5	-36.1	-70.7	-25.0	-68.7	-88.9	-89.8	35.9	191.1	[dB]
LSR integral@520ft	-17.3	-7.1	-5.1	-1.7	2.6	2.8	7.1	2.2	-4.7	-16.8	-16.6	-39.3	-48.9	-64.1	-59.9	-26.1	[dB]
FDL, FTA [max scaled to 15mph]			19	23	26	22	23	24	17	15	12	15	19	22	21	14	[dB]
FDL, VTA data [scaled to 15mph]			17	22	28	20	21	20	19	21	25	29	32	35	32	29	[dB]
Predicted velocity, based on FDL from FTA			5	12	28	18	34	22	4	1	1	0	0	0	0	0	[uin/s]
Predicted velocity, based on FDL from VTA			4	10	32	13	24	12	5	2	2	0	0	0	0	1	[uin/s]
VC-G	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32		[uin/s]

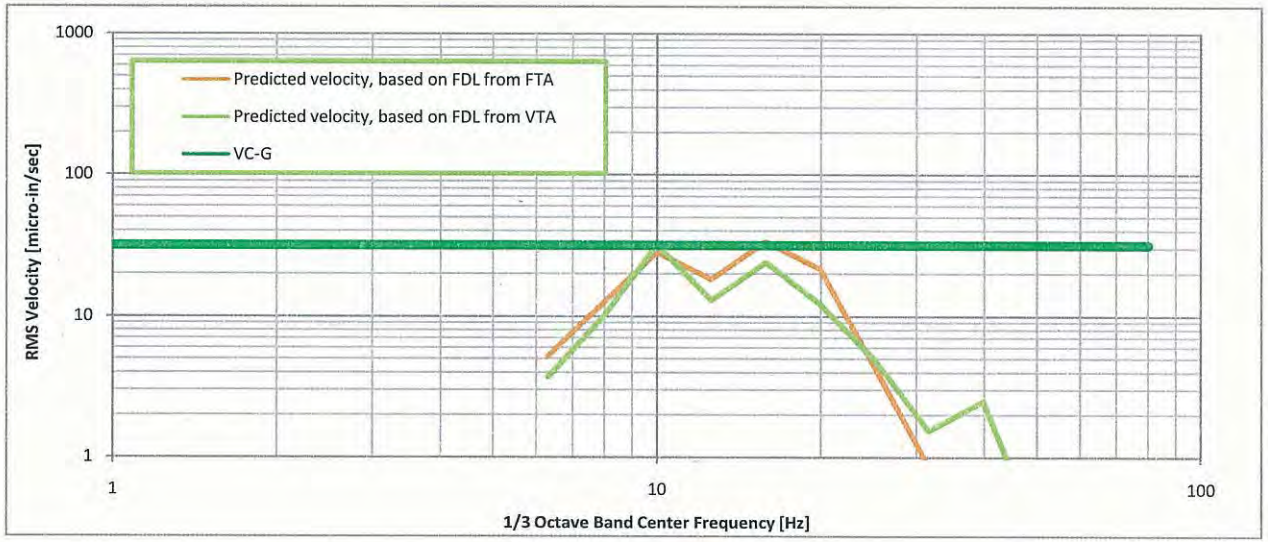


Figure 10: University of Maryland / Purple Line – December 2008
Predicted vibration velocity spectrum along Preinkert Drive Alternative, meeting VC-G at 400' setback

Building: <ARBITRARY>
Setback: 400 (Preinkert Drive Al't)
Train Length: 160

Note: PSR terms based on quadratic regression of mobility [dB] vs. log distance [ft]; LSR integral uses 9-segments.
Velocity prediction based on v[dB] = FDL + LSR; velocities presented in linear terms for convenience.
A reported velocity of "0" in the table is not really zero; figures are rounded to the nearest whole number.

	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126	
Preinkert Drive PSR r^2 term	-5.5	-23.3	-6.9	3.1	-4.2	-5.9	-12.3	-31.6	-40.3	-38.9	-34.1	-35.2	-13.9	-10.0	-15.1	6.8	[dB]
Preinkert Drive PSR r^1 term	4.3	68.6	7.8	-30.4	-0.3	4.2	28.4	101.5	126.6	118.1	97.9	93.8	14.2	-1.1	15.0	-69.5	[dB]
Preinkert Drive PSR r^0 term	-7.0	-59.4	-2.2	35.8	9.8	8.2	-12.2	-73.9	-87.8	-76.6	-58.8	-51.9	18.4	30.6	13.7	86.8	[dB]
LSR integral@400ft	-11.3	-16.6	-6.5	-0.1	2.6	1.3	0.5	-2.2	-9.6	-10.9	-13.2	-24.6	-17.0	-17.9	-27.9	-25.7	[dB]
FDL, FTA [max scaled to 15mph]			19	23	26	22	23	24	17	15	12	15	19	22	21	14	[dB]
FDL, VTA data [scaled to 15mph]			17	22	28	20	21	20	19	21	25	29	32	35	32	29	[dB]
Predicted velocity, based on FDL from FTA			4	15	28	15	16	13	2	2	1	0	1	2	0	0	[uin/s]
Predicted velocity, based on FDL from VTA			3	12	32	11	11	7	3	3	4	2	5	7	2	1	[uin/s]
VC-G	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32		[uin/s]

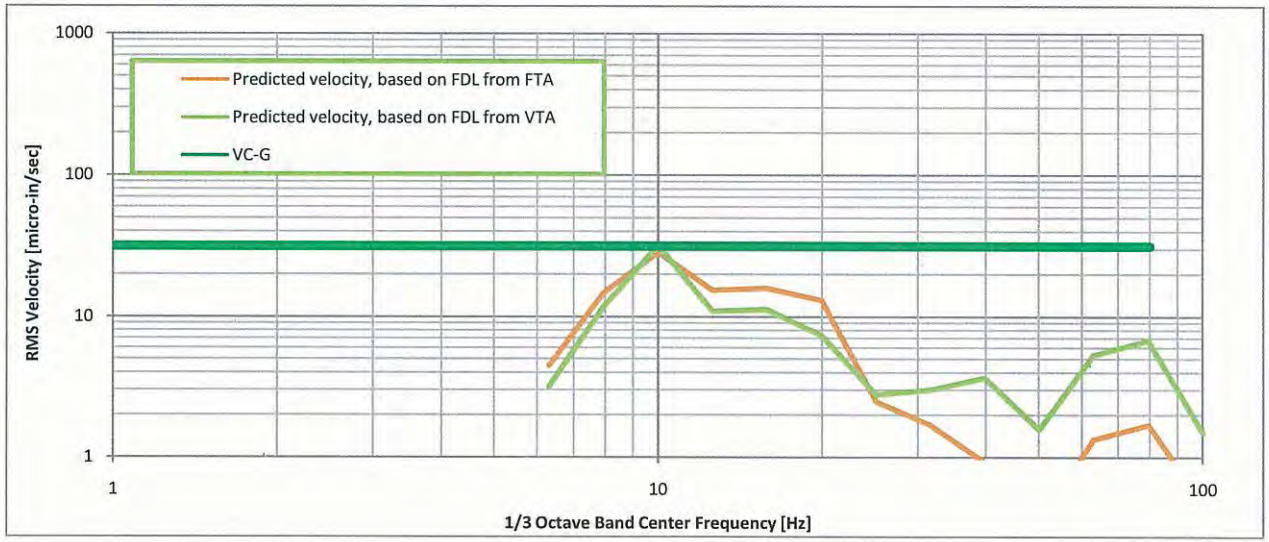


Figure 11: University of Maryland / Purple Line – December 2008
Campus map illustrating predicted setbacks required to meet NIST-A and VC-F criteria

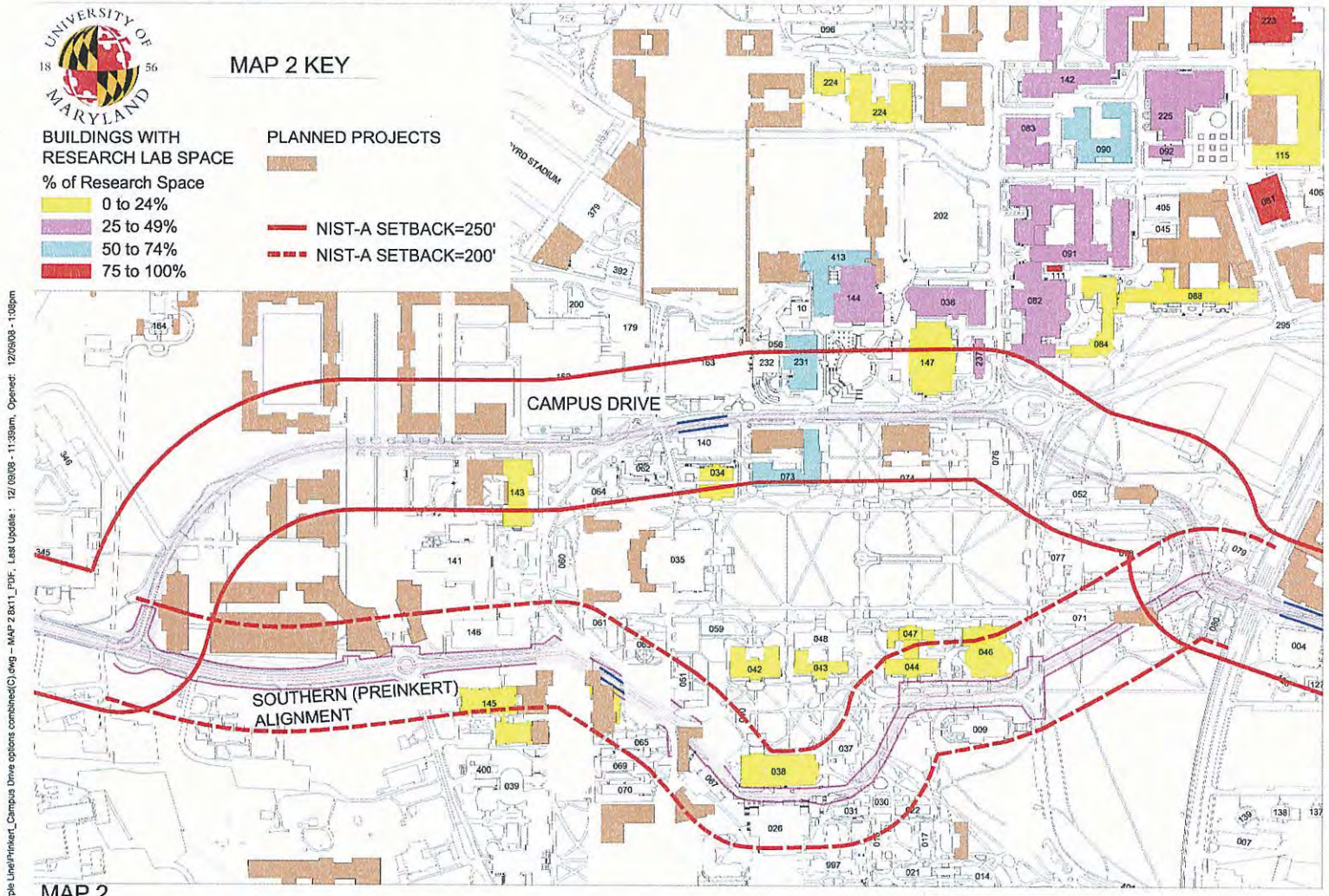
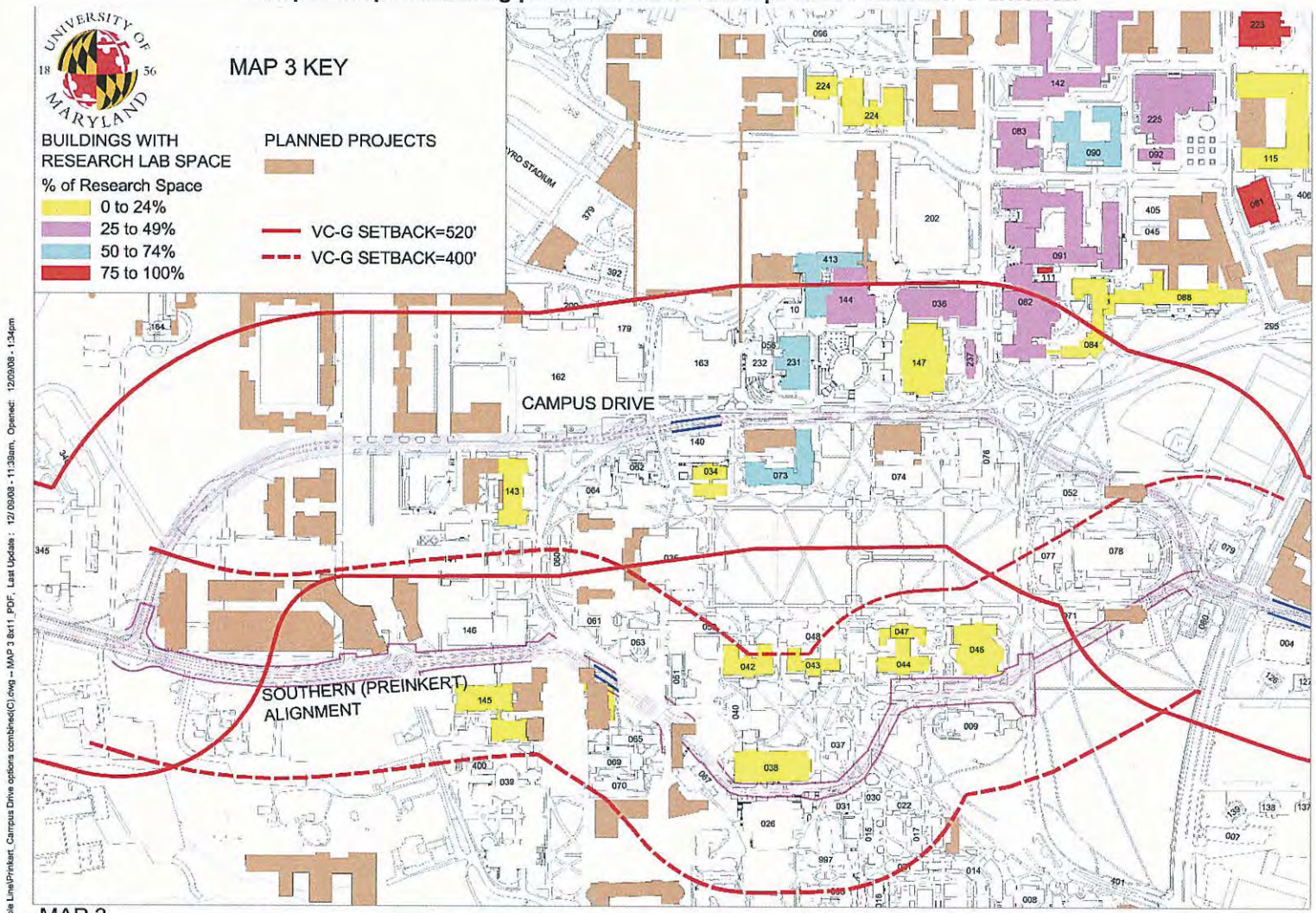


Figure 12: University of Maryland / Purple Line – December 2008
Campus map illustrating predicted setbacks required to meet VC-G criterion



MAP 3
SETBACKS REQUIRED TO MEET VC-G CRITERIA FOR VIBRATION
DATE:11-02-08
SOURCE OF DATA: JOHN BRANDON AND ASSOCIATES

mdFac\Planning\Purple Line\Prinkert_Campus Drive options combined(C).dwg -- MAP 3 8x11_PDF, Last Update : 12/09/08 - 11:39am, Opened: 12/09/08 - 1:34pm

Appendix A: Generic Design Criteria for Vibration-Sensitive Equipment and Processes

This appendix presents vibration criteria that have been used quite extensively for over two decades, particularly in the microelectronics industry. The criteria take the form of a set of one-third octave band velocity spectra, which are labeled vibration criterion curves VC-A through VC-G. These are shown in Figure A.1, together with the International Standards Organization (ISO) guidelines for the effects of vibration on people in buildings. The criteria apply to vibration as measured in the vertical and two horizontal directions. The application of these criteria as they apply to people and vibration-sensitive equipment is described in Table A.1. The main elements of the criteria follow:

1) The floor vibration is expressed in terms of its root-mean-square (RMS) velocity (as opposed to displacement or acceleration). It has been found in various studies that while different items of equipment (and people) may exhibit maximum sensitivity at different frequencies (corresponding to internal resonances), often these points of maximum sensitivity lie on a curve of constant velocity.

   Note: There is little validity in a criterion that attempts to define a vibration displacement limit based on a small fraction of the dimension being examined (in the case of metrology) or inscribed (in the case of lithography). The resonant responses of most systems are too complex for this simplistic approach.

2) The use of a proportional bandwidth (the bandwidth of the one-third octave is twenty-three percent of the band center frequency) as opposed to a fixed bandwidth is justified on the basis of a conservative view of the internal damping of typical equipment components. Experience shows that in most environments the vibration is dominated by broadband (random) energy rather than tonal (periodic) energy.

3) The fact that the criterion curves allow for greater vibration velocity for frequencies below 8 Hz reflects experience that this frequency range, in most instances, lies below the lowest resonance frequency. Relative motions between the components are, therefore, harder to excite and the sensitivity to vibration is reduced.

4) For a site to comply with a particular equipment category the measured one-third octave band velocity spectrum must lie below the appropriate criterion curve of Figure A.1.

These equipment criterion curves have been developed on the basis of data on individual items of equipment and from data obtained from measurements made in facilities before and after vibration-related problems were solved. The curves are generic in the sense that they are intended to apply to broadly defined classes of equipment and processes. **They are intended to apply to the more sensitive equipment within each category that is defined.**

The criteria assume that bench-mounted equipment will be supported on benches that are rigidly constructed and damped so that amplification due to resonances are limited to a small value. The criteria take into account the fact that certain types of equipment (such as SEMs) are supplied by the manufacturer with built-in vibration isolation.

It is important to note that these criteria are for guidance only. The "detail sizes" given in Table A.1 appear to represent experience at the time of writing. They reflect the fact that the quality of design and of built-in isolation in most equipment tends to improve as dimensional requirements become more stringent. In some instances the criteria may be overly conservative because of the high quality of built-in isolation. Thus, for instance, many steppers used in photolithography are, currently, relatively insensitive to vibration. In most instances it is recommended that the advice of equipment manufacturers or of a vibration consultant be sought in selecting a design standard.

Figure A.1: Generic Vibration Criterion (VC) Curves for vibration-sensitive equipment and processes. The ISO Guidelines for people in buildings are shown for reference.

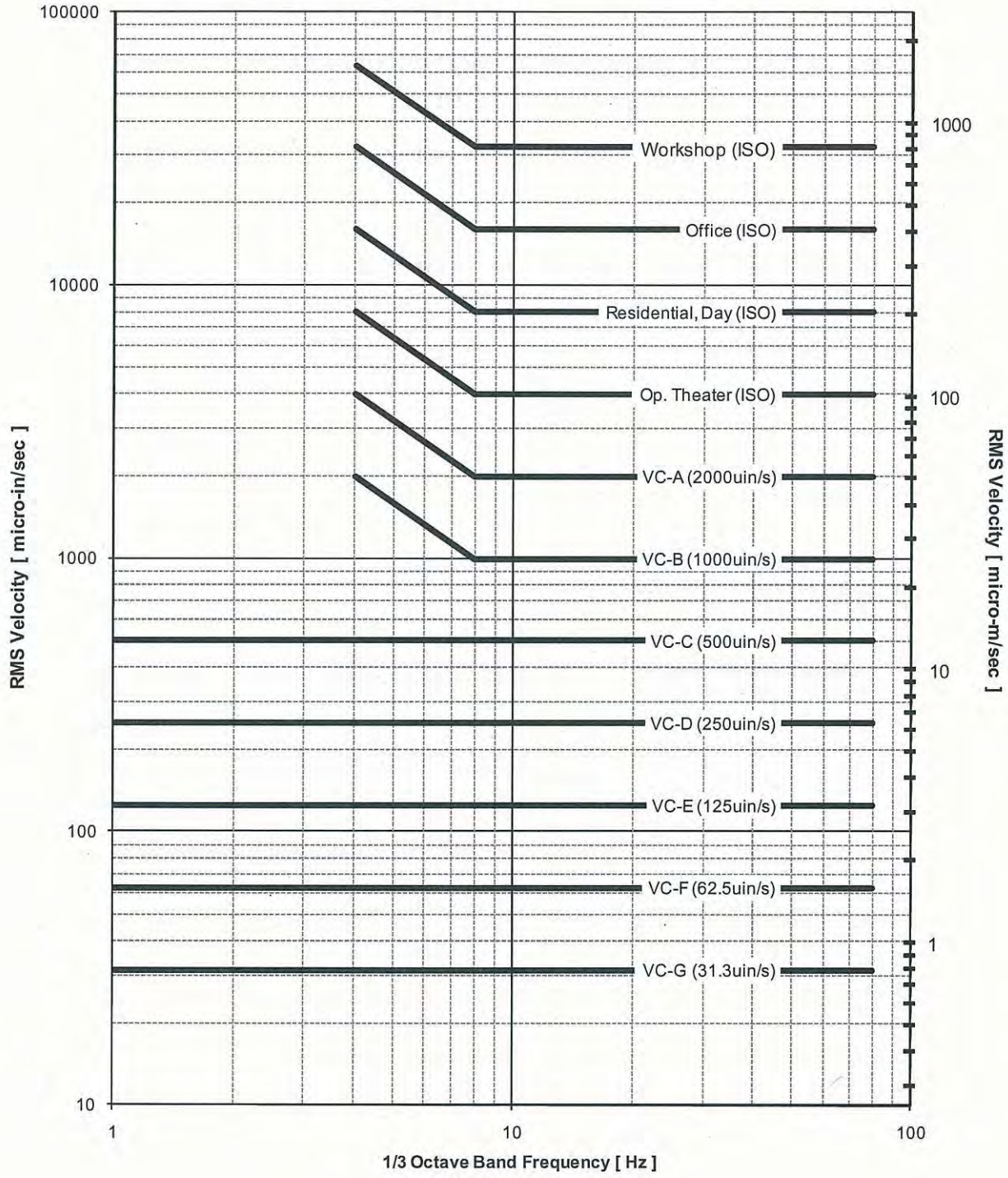


Figure A.2: VC Curves (US Customary Units), Plotted on a Nomograph Simultaneously Depicting Displacement, Velocity, and Acceleration

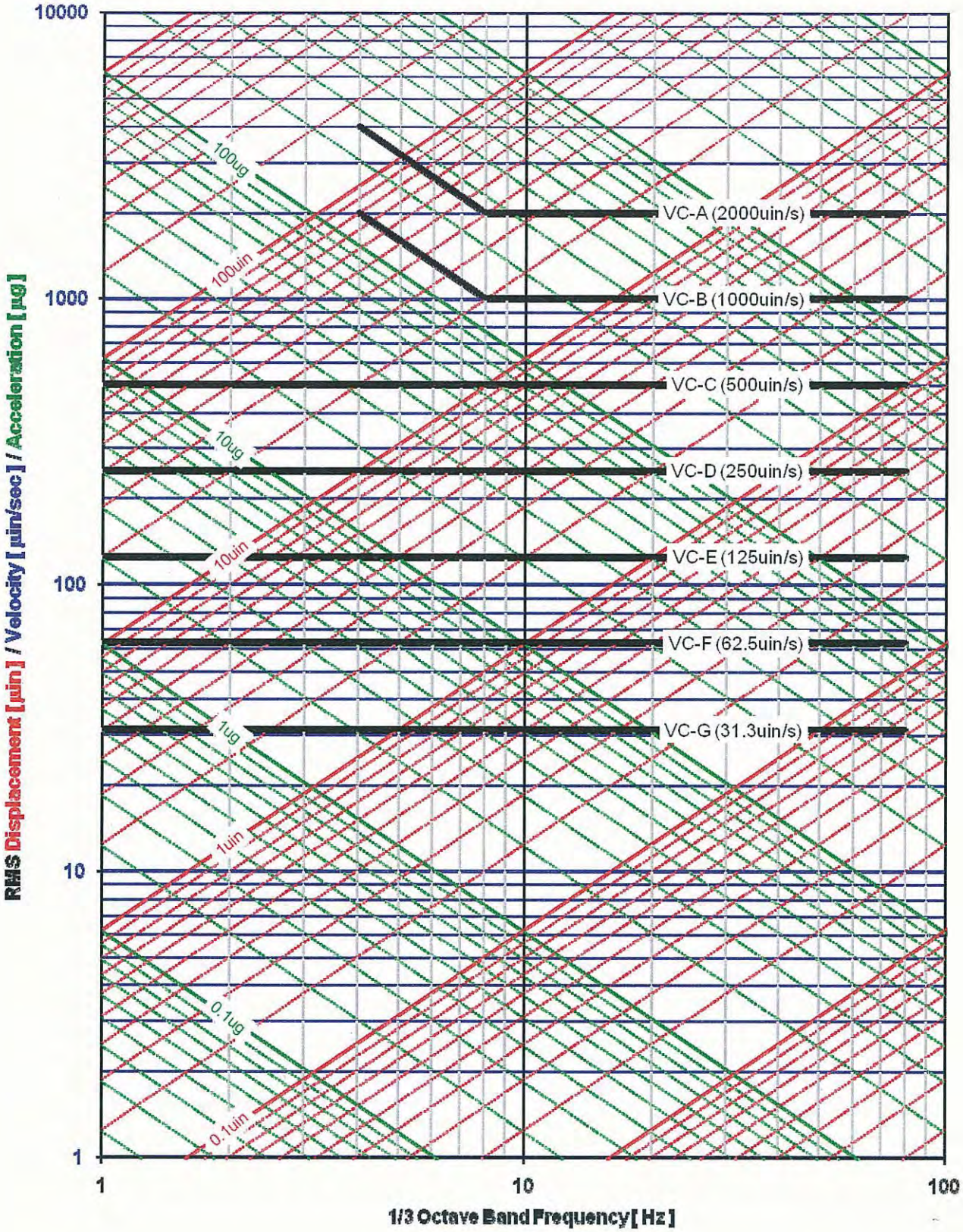


Table A.1: Application and interpretation of the generic vibration criterion (VC) curves (as shown in Figure A.1)

Criterion Curve (see Figure 1)	Amplitude (1) micro-in/s (micro-m/s)	Detail Size (2) microns	Description of Use
Workshop (ISO)	32000 (800)	N/A	Distinctly feelable vibration. Appropriate to workshops and nonsensitive areas.
Office (ISO)	16000 (400)	N/A	Feelable vibration. Appropriate for offices and nonsensitive areas.
Residential Day (ISO)	8000 (200)	75	Barely perceptible vibration. Appropriate for sleep areas. Usually adequate for computer equipment, probe test equipment, and microscopes less than 40x.
Op. Theatre (ISO)	4000 (100)	25	Vibration not perceptible Suitable for sensitive sleep areas. Suitable in most instances for microscopes to 100X and for other equipment of low sensitivity.
VC-A	2000 (50)	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	1000 (25)	3	Appropriate for inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C	500 (12.5)	1 - 3	Appropriate standard for optical microscopes to 1000x, lithography and inspection equipment (including moderately sensitive electron microscopes) to 1 μm detail size.
VC-D	250 (6.3)	0.1 - 0.3	Suitable in most instances for demanding equipment, including many electron microscopes (TEMs and SEMs) and E-Beam systems.
VC-E	125 (3.12)	<0.1	A challenging criterion to achieve. Assumed to be adequate for the most demanding of sensitive systems, including long path, laser-based, small target systems, electron-beam lithography systems working at nanometer scale, and other systems requiring extraordinary dynamic stability.
VC-F	62.5 (1.56)	N/A	Appropriate for extremely quiet research spaces; generally difficult to achieve in most instances, especially cleanrooms. Not recommended for use as a design criterion, only for characterization.
VC-G	31.3 (0.78)	N/A	Appropriate for extremely quiet research spaces; generally difficult to achieve in most instances, especially cleanrooms. Not recommended for use as a design criterion, only for characterization.

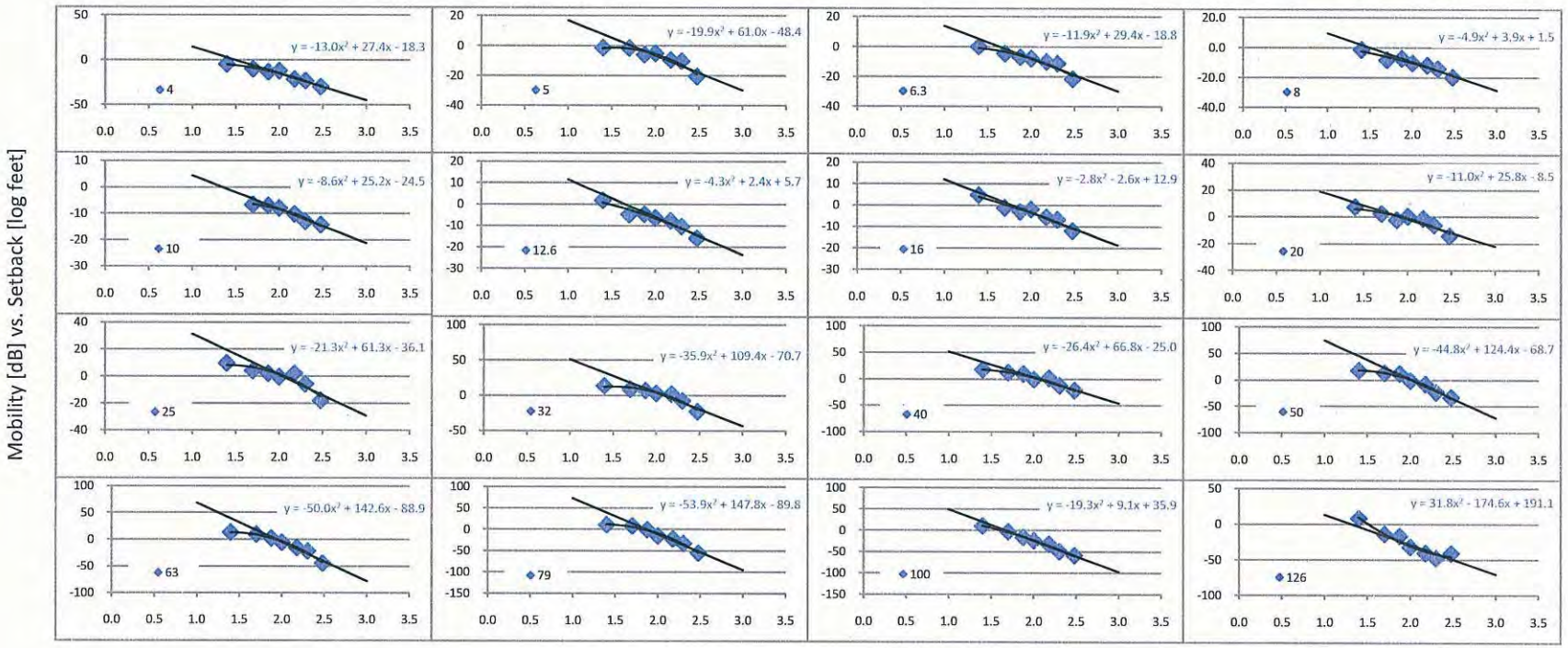
Notes:

(1) As measured in one-third octave bands of frequency over the frequency range 8 to 80 Hz (VC-A and VC-B) or 1 to 80 Hz (VC-C through VC-G)

(2) The detail size refers to the line widths for microelectronics fabrication, particle (cell) size for medical and pharmaceutical research, etc. Detail size is not relevant to imaging associated with probe technologies, AFMs, and nanotechnology.

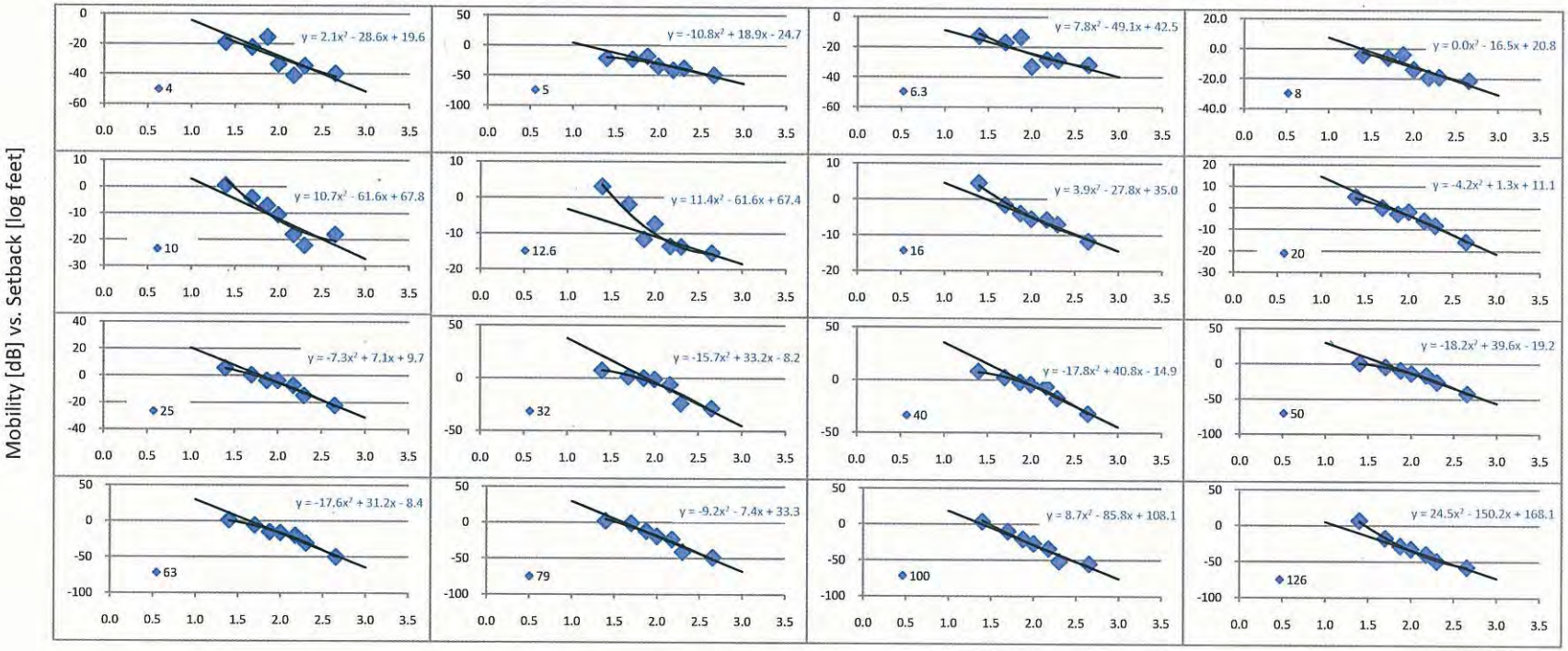
Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
A.0	25	1.4	-4.8	-1.5	-0.1	-1.5	0.1	1.8	4.7	7.2	9.7	13.6	17.2	17.2	12.9	10.7	10.5	7.9
	50	1.7	-10.1	-1.7	-4.7	-8.3	-6.8	-4.9	-1.3	2.2	4.1	8.6	11.5	12.6	9.2	8.0	-3.0	-14.1
	75	1.9	-13.4	-6.0	-7.2	-7.3	-7.2	-4.7	-3.1	-2.5	2.1	7.1	9.0	11.4	2.1	-0.8	-16.1	-16.8
	100	2.0	-12.2	-5.1	-8.0	-10.4	-8.0	-6.5	-2.0	0.2	-0.4	2.9	-1.6	-2.0	-5.9	-15.3	-23.8	-32.3
	150	2.2	-21.4	-9.6	-10.2	-11.8	-10.2	-7.8	-5.6	-1.4	2.1	1.9	1.0	-8.4	-15.6	-22.1	-32.3	-40.7
	200	2.3	-23.3	-10.4	-11.3	-14.1	-13.0	-10.4	-6.8	-6.4	-5.7	-7.7	-13.3	-23.4	-21.7	-33.0	-49.4	-47.9
	300	2.5	-29.9	-20.6	-21.7	-19.8	-14.3	-15.8	-12.0	-14.4	-18.1	-22.9	-22.0	-33.4	-44.9	-55.3	-58.7	-41.4
		r^2	**-13.0**	**-19.9**	**-11.9**	**-4.9**	-8.6	**-4.3**	**-2.8**	**-11.0**	**-21.3**	**-35.9**	**-26.4**	**-44.8**	**-50.0**	**-53.9**	**-19.3**	**31.8**
		r^1	**27.4**	**61.0**	**29.4**	**3.9**	25.2	**2.4**	**-2.6**	**25.8**	**61.3**	**109.4**	**66.8**	**124.4**	**142.6**	**147.8**	**9.1**	**-174.6**
		r^0	**-18.3**	**-48.4**	**-18.8**	**1.5**	-24.5	**5.7**	**12.9**	**-8.5**	**-36.1**	**-70.7**	**-25.0**	**-68.7**	**-88.9**	**-89.8**	**35.9**	**191.1**



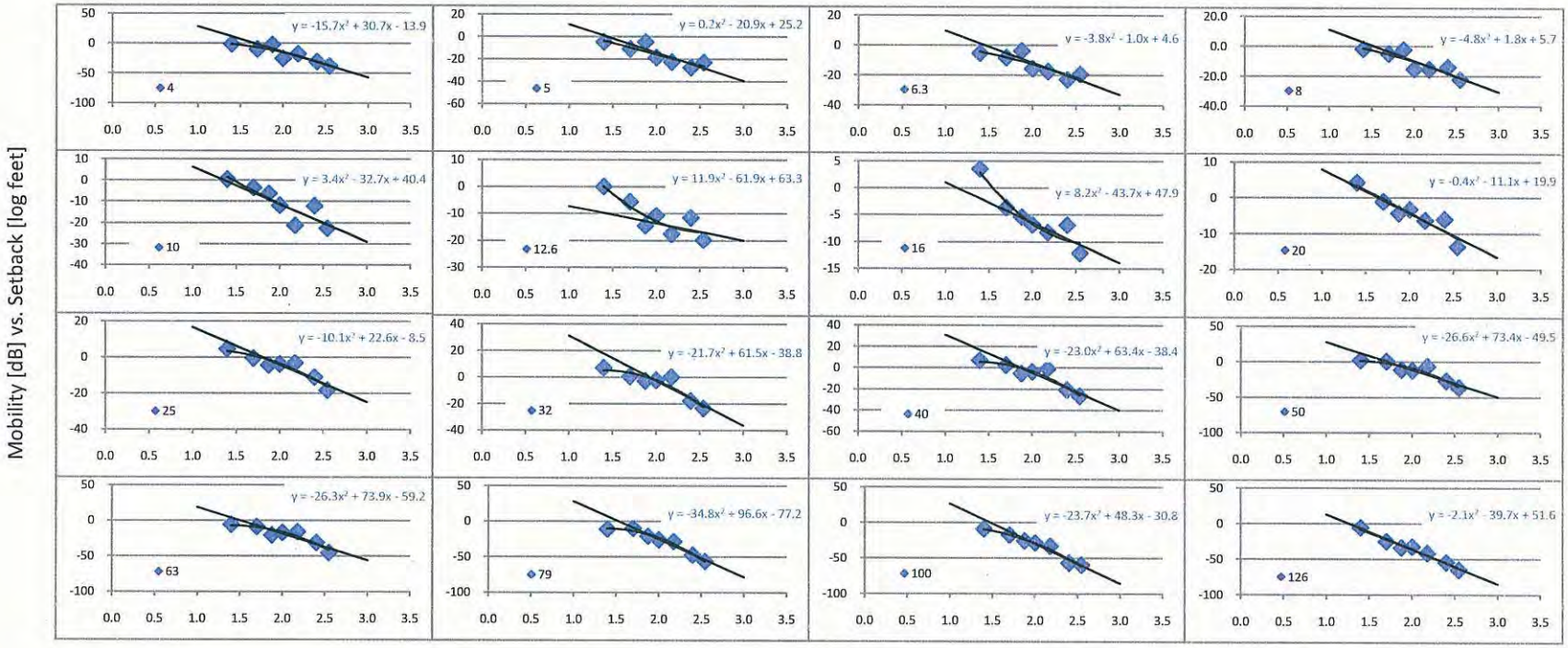
Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
B.1	25	1.4	-18.9	-21.7	-12.7	-4.2	0.6	3.1	4.5	5.1	5.6	7.1	7.8	0.7	1.4	2.0	3.3	6.9
	50	1.7	-22.0	-23.0	-16.9	-6.0	-4.2	-1.9	-1.6	0.0	0.5	1.1	2.0	-4.9	-5.8	-1.3	-10.2	-17.6
	75	1.9	-15.4	-18.3	-13.4	-3.9	-7.2	-11.6	-4.0	-2.8	-3.7	0.0	-2.5	-9.4	-15.1	-12.2	-20.9	-28.6
	100	2.0	-33.4	-34.6	-33.1	-13.8	-10.6	-7.4	-5.6	-1.8	-3.8	-1.3	-4.7	-13.8	-16.1	-19.3	-27.3	-32.6
	150	2.2	-40.9	-41.3	-28.4	-19.2	-18.1	-13.6	-5.7	-6.0	-7.3	-6.4	-6.7	-16.5	-20.0	-23.6	-34.1	-39.8
	200	2.3	-34.6	-38.0	-29.1	-18.8	-22.2	-13.7	-7.0	-8.3	-14.9	-24.2	-17.7	-26.5	-31.0	-41.0	-51.8	-49.6
	450	2.7	-39.6	-49.5	-31.9	-21.1	-18.0	-15.5	-11.8	-15.8	-22.3	-28.7	-32.3	-42.5	-50.0	-48.7	-55.4	-57.7
		r^2	**-13.0**	**-19.9**	**-11.9**	**-4.9**	**88.0**	**-4.3**	**-2.8**	**-11.0**	**-21.3**	**-35.9**	**-26.4**	**-44.8**	**-50.0**	**-53.9**	**-19.3**	**31.8**
		r^1	**27.4**	**61.0**	**29.4**	**3.9**	**-23.5**	**2.4**	**-2.6**	**25.8**	**61.3**	**109.4**	**66.8**	**124.4**	**142.6**	**147.8**	**9.1**	**-174.6**
		r^0	**-18.3**	**-48.4**	**-18.8**	**1.5**	**26.8**	**5.7**	**12.9**	**-8.5**	**-36.1**	**-70.7**	**-25.0**	**-68.7**	**-88.9**	**-89.8**	**35.9**	**191.1**



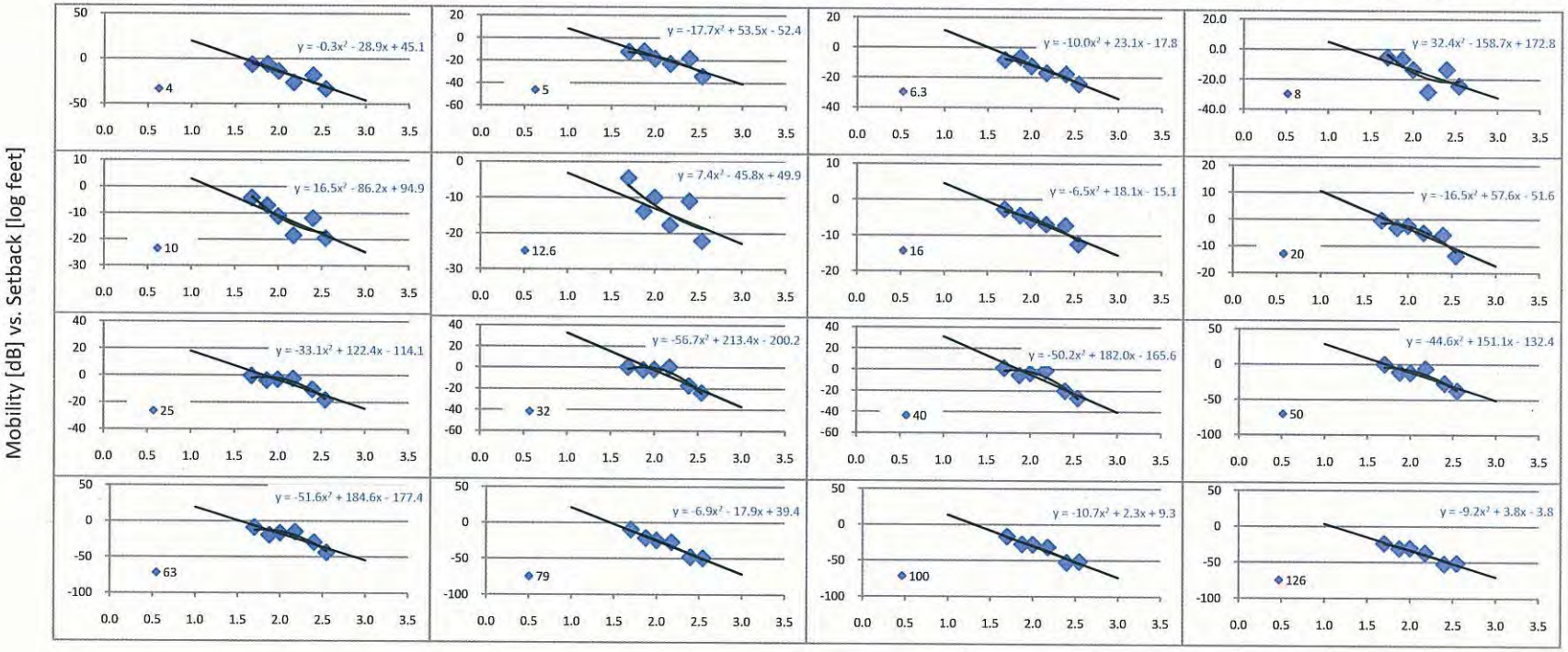
Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
B.2	25	1.4	-1.3	-4.8	-5.3	-1.8	0.3	0.0	3.5	4.3	4.7	6.9	6.8	1.9	-5.8	-11.1	-9.3	-5.9
	50	1.7	-10.0	-11.0	-8.3	-5.0	-3.7	-5.6	-3.7	-1.1	-0.5	0.4	2.3	0.5	-9.0	-9.9	-17.6	-25.4
	75	1.9	-2.2	-4.9	-3.9	-2.4	-6.4	-14.5	-5.4	-4.3	-4.4	-2.9	-5.5	-11.4	-20.6	-21.0	-25.8	-33.9
	100	2.0	-25.4	-18.7	-15.6	-15.2	-12.0	-10.7	-6.9	-3.2	-3.8	-2.4	-3.9	-12.2	-17.2	-26.0	-28.6	-32.8
	150	2.2	-17.6	-22.5	-17.5	-15.4	-21.4	-17.6	-8.3	-6.3	-3.1	0.0	-1.3	-6.7	-15.9	-28.4	-33.3	-41.7
	250	2.4	-30.6	-27.5	-22.9	-14.0	-12.2	-11.5	-6.9	-6.0	-11.0	-18.0	-20.8	-27.0	-31.1	-47.3	-56.7	-54.7
	350	2.5	-37.7	-23.0	-19.4	-22.3	-22.7	-19.8	-12.1	-13.6	-18.3	-23.4	-26.8	-36.6	-45.1	-56.3	-59.5	-65.0
		r^2	**-13.0**	**-19.9**	**-11.9**	**-4.9**	**2.8**	**-4.3**	**-2.8**	**-11.0**	**-21.3**	**-35.9**	**-26.4**	**-44.8**	**-50.0**	**-53.9**	**-19.3**	**31.8**
		r^1	**27.4**	**61.0**	**29.4**	**3.9**	**-23.5**	**2.4**	**-2.6**	**25.8**	**61.3**	**109.4**	**66.8**	**124.4**	**142.6**	**147.8**	**9.1**	**-174.6**
		r^0	**-18.3**	**-48.4**	**-18.8**	**1.5**	**26.8**	**5.7**	**12.9**	**-8.5**	**-36.1**	**-70.7**	**-25.0**	**-68.7**	**-88.9**	**-89.8**	**35.9**	**191.1**



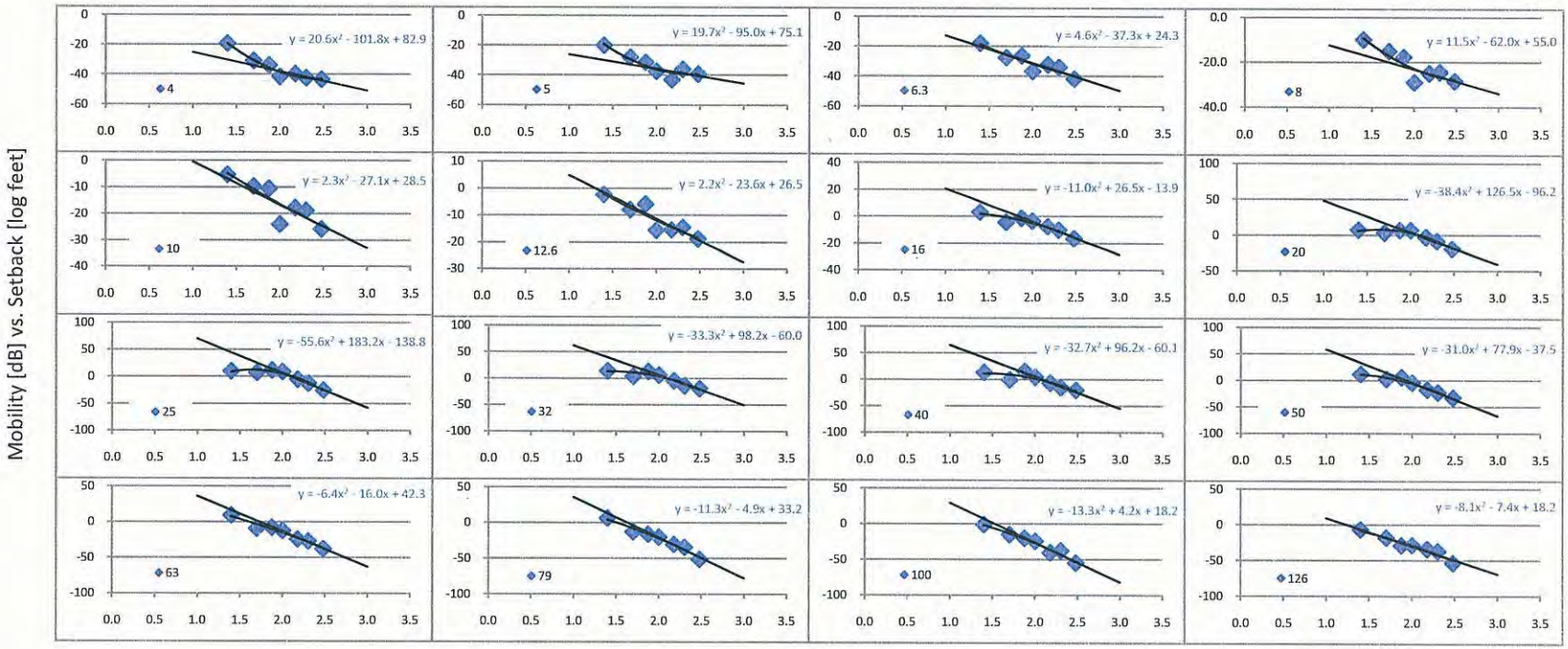
Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
B.3																		
	50	1.7	-6.4	-12.3	-8.5	-5.2	-4.3	-4.6	-2.8	-0.5	-0.3	0.2	1.3	-0.6	-8.8	-9.7	-16.9	-23.9
	75	1.9	-6.0	-11.8	-6.6	-6.6	-7.2	-13.8	-4.5	-3.3	-3.7	-2.4	-5.6	-11.7	-19.4	-21.5	-27.6	-31.0
	100	2.0	-13.9	-18.5	-12.5	-13.4	-11.2	-10.0	-5.7	-2.5	-3.0	-1.9	-3.7	-12.2	-16.3	-24.7	-28.0	-30.7
	150	2.2	-26.5	-22.9	-17.0	-28.3	-18.5	-17.7	-7.0	-5.1	-2.4	0.3	-1.2	-6.8	-14.8	-27.1	-31.7	-37.2
	250	2.4	-18.6	-18.2	-17.7	-13.4	-12.0	-11.0	-7.3	-5.9	-10.5	-17.3	-20.4	-27.2	-29.6	-47.9	-53.0	-52.5
	350	2.5	-33.5	-34.2	-24.3	-24.3	-19.6	-22.1	-12.5	-13.6	-18.3	-24.0	-27.2	-37.7	-43.9	-49.3	-51.7	-51.3
		r^2	**-20.5**	**-26.6**	**-30.6**	**-22.8**	**-8.6**	**-23.3**	**-19.0**	**-33.2**	**-53.3**	**-66.3**	**-33.6**	**-37.3**	**-54.8**	**-40.5**	**-11.5**	**57.3**
		r^1	**59.8**	**89.7**	**109.2**	**80.6**	**25.2**	**83.5**	**66.5**	**120.5**	**197.8**	**238.8**	**97.5**	**92.6**	**162.9**	**90.5**	**-24.1**	**-283.3**
		r^0	**-52.3**	**-78.6**	**-102.8**	**-79.2**	**-24.5**	**-79.7**	**-59.8**	**-108.3**	**-179.8**	**-206.9**	**-57.2**	**-35.2**	**-110.3**	**-29.5**	**70.8**	**305.6**



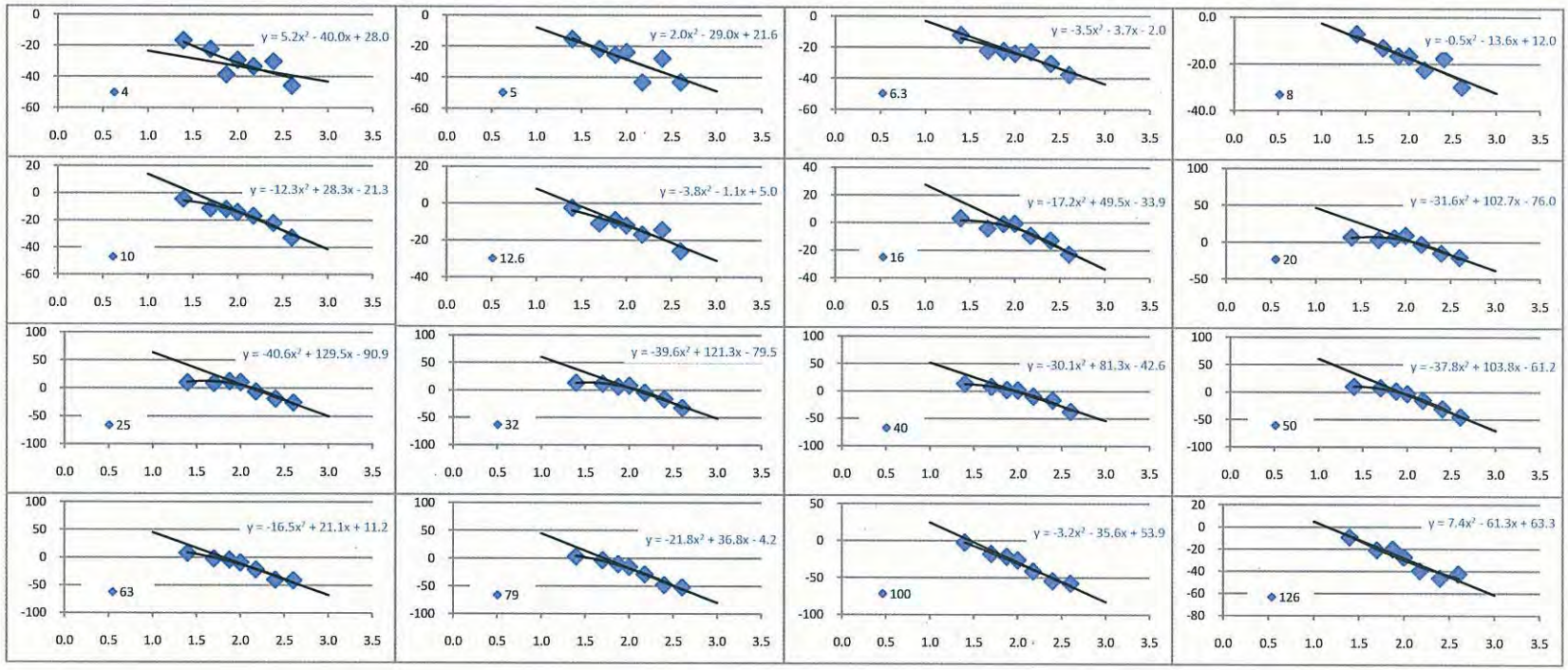
Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
D.1	25	1.4	-19.3	-20.1	-18.0	-10.0	-5.4	-2.3	3.1	7.2	9.8	13.8	12.6	11.1	9.4	6.4	-1.2	-6.8
	50	1.7	-30.9	-28.1	-27.6	-15.2	-9.8	-8.0	-4.4	3.2	7.3	3.5	-1.3	1.9	-9.2	-12.9	-15.3	-18.2
	75	1.9	-33.9	-31.5	-26.4	-17.8	-10.6	-5.9	-1.4	6.7	11.6	13.0	14.6	5.0	-7.7	-16.2	-20.2	-29.0
	100	2.0	-41.6	-37.4	-36.8	-29.0	-24.1	-15.6	-3.6	6.9	8.9	5.8	3.8	-5.0	-12.2	-20.1	-24.4	-28.6
	150	2.2	-39.7	-43.1	-32.4	-25.0	-17.9	-15.4	-7.7	-3.0	-5.3	-4.7	-7.3	-18.2	-24.1	-30.3	-40.4	-34.0
	200	2.3	-42.4	-36.2	-34.0	-24.5	-18.9	-14.5	-10.2	-8.6	-12.7	-14.0	-15.8	-23.3	-26.7	-34.5	-37.7	-37.2
	300	2.5	-43.5	-39.3	-41.8	-28.4	-25.9	-18.8	-16.6	-18.9	-25.6	-19.5	-20.8	-33.3	-37.6	-51.5	-54.8	-53.7
		r^2	**-13.0**	**-19.9**	**-11.9**	**-4.9**	**2.8**	**-4.3**	**-2.8**	**-11.0**	**-21.3**	**-35.9**	**-26.4**	**-44.8**	**-50.0**	**-53.9**	**-19.3**	**31.8**
		r^1	**27.4**	**61.0**	**29.4**	**3.9**	**-23.5**	**2.4**	**-2.6**	**25.8**	**61.3**	**109.4**	**66.8**	**124.4**	**142.6**	**147.8**	**9.1**	**-174.6**
		r^0	**-18.3**	**-48.4**	**-18.8**	**1.5**	**26.8**	**5.7**	**12.9**	**-8.5**	**-36.1**	**-70.7**	**-25.0**	**-68.7**	**-88.9**	**-89.8**	**35.9**	**191.1**



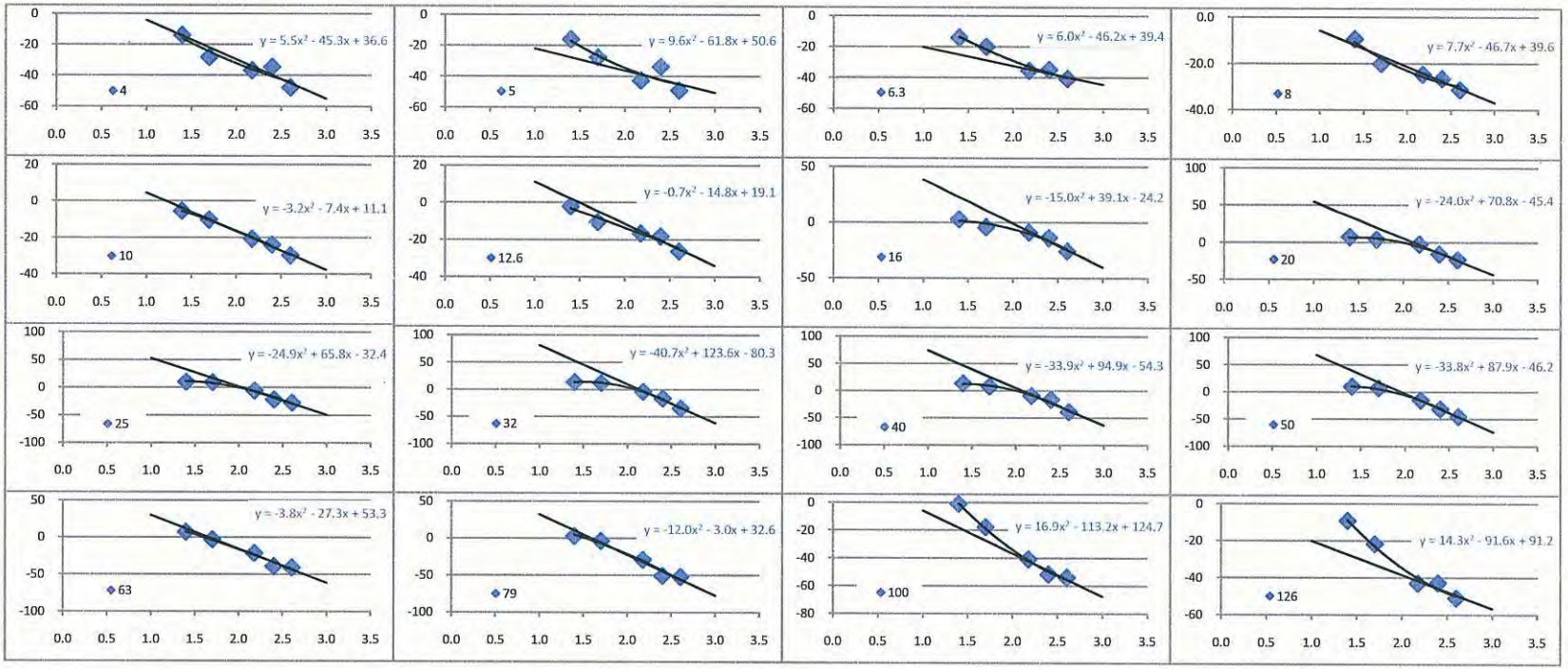
Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
D.2	25	1.4	-16.6	-15.3	-12.1	-7.3	-4.5	-2.5	3.3	6.8	10.3	13.0	13.1	9.5	7.9	3.1	-2.5	-9.3
	50	1.7	-22.3	-21.7	-22.1	-13.2	-11.5	-11.0	-4.1	3.3	9.4	11.5	7.6	7.0	-2.2	-3.4	-17.8	-20.9
	75	1.9	-38.6	-25.4	-22.5	-16.6	-12.0	-9.1	-0.9	5.7	12.6	6.1	1.9	1.2	-4.1	-10.5	-21.6	-20.0
	100	2.0	-29.2	-23.7	-24.0	-16.7	-14.2	-12.1	-0.5	9.0	11.0	8.2	1.2	-3.5	-9.1	-15.4	-26.4	-27.4
	150	2.2	-33.3	-43.1	-23.0	-22.6	-17.0	-17.0	-9.3	-3.1	-5.8	-4.6	-10.0	-15.5	-21.7	-28.7	-41.3	-39.8
	250	2.4	-30.2	-27.8	-30.4	-17.7	-22.3	-14.5	-12.7	-15.1	-18.6	-16.1	-16.7	-30.8	-40.2	-48.0	-54.4	-46.4
	400	2.6	-45.8	-43.0	-37.5	-29.9	-33.1	-26.0	-22.8	-20.9	-25.5	-32.6	-37.5	-45.5	-41.2	-52.1	-57.6	-42.4
		r^2	**-13.0**	**-19.9**	**-11.9**	**-4.9**	**2.8**	**-4.3**	**-2.8**	**-11.0**	**-21.3**	**-35.9**	**-26.4**	**-44.8**	**-50.0**	**-53.9**	**-19.3**	**31.8**
		r^1	**27.4**	**61.0**	**29.4**	**3.9**	**-23.5**	**2.4**	**-2.6**	**25.8**	**61.3**	**109.4**	**66.8**	**124.4**	**142.6**	**147.8**	**9.1**	**-174.6**
		r^0	**-18.3**	**-48.4**	**-18.8**	**1.5**	**26.8**	**5.7**	**12.9**	**-8.5**	**-36.1**	**-70.7**	**-25.0**	**-68.7**	**-88.9**	**-89.8**	**35.9**	**191.1**



Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
D.3	25	1.4	-14.1	-16.1	-14.2	-9.5	-5.5	-1.9	2.9	7.3	10.0	13.2	13.2	9.8	7.1	3.0	-1.1	-9.2
	50	1.7	-28.2	-27.8	-20.1	-20.1	-10.2	-10.3	-4.2	4.0	9.1	11.6	7.4	6.8	-3.1	-3.6	-17.8	-21.8
	150	2.2	-36.8	-42.8	-35.5	-24.7	-20.7	-16.5	-9.0	-2.5	-6.0	-4.5	-9.8	-15.4	-21.4	-29.1	-41.0	-43.0
	250	2.4	-34.5	-33.8	-34.9	-26.5	-23.9	-18.1	-13.7	-15.7	-22.0	-16.8	-16.7	-31.7	-39.1	-50.8	-51.8	-42.8
	400	2.6	-47.8	-49.2	-40.7	-31.4	-29.8	-26.2	-25.9	-23.3	-27.7	-35.2	-39.4	-45.6	-40.7	-52.2	-54.1	-51.0
		r^2	**-18.3**	**-56.0**	**-56.5**	**-18.3**	**-1.2**	**-25.3**	**-28.6**	**-73.8**	**-93.4**	**-92.2**	**-36.9**	**5.5**	**-77.6**	**-55.6**	**-21.8**	**150.5**
		r^1	**49.8**	**220.0**	**223.5**	**60.4**	**-7.7**	**92.5**	**108.9**	**300.4**	**375.5**	**353.6**	**112.2**	**-97.0**	**263.8**	**157.7**	**21.4**	**-696.0**
		r^0	**-41.4**	**-221.7**	**-228.4**	**-56.9**	**11.6**	**-89.6**	**-106.4**	**-305.8**	**-375.0**	**-333.0**	**-73.5**	**172.9**	**-221.1**	**-103.3**	**20.8**	**758.9**



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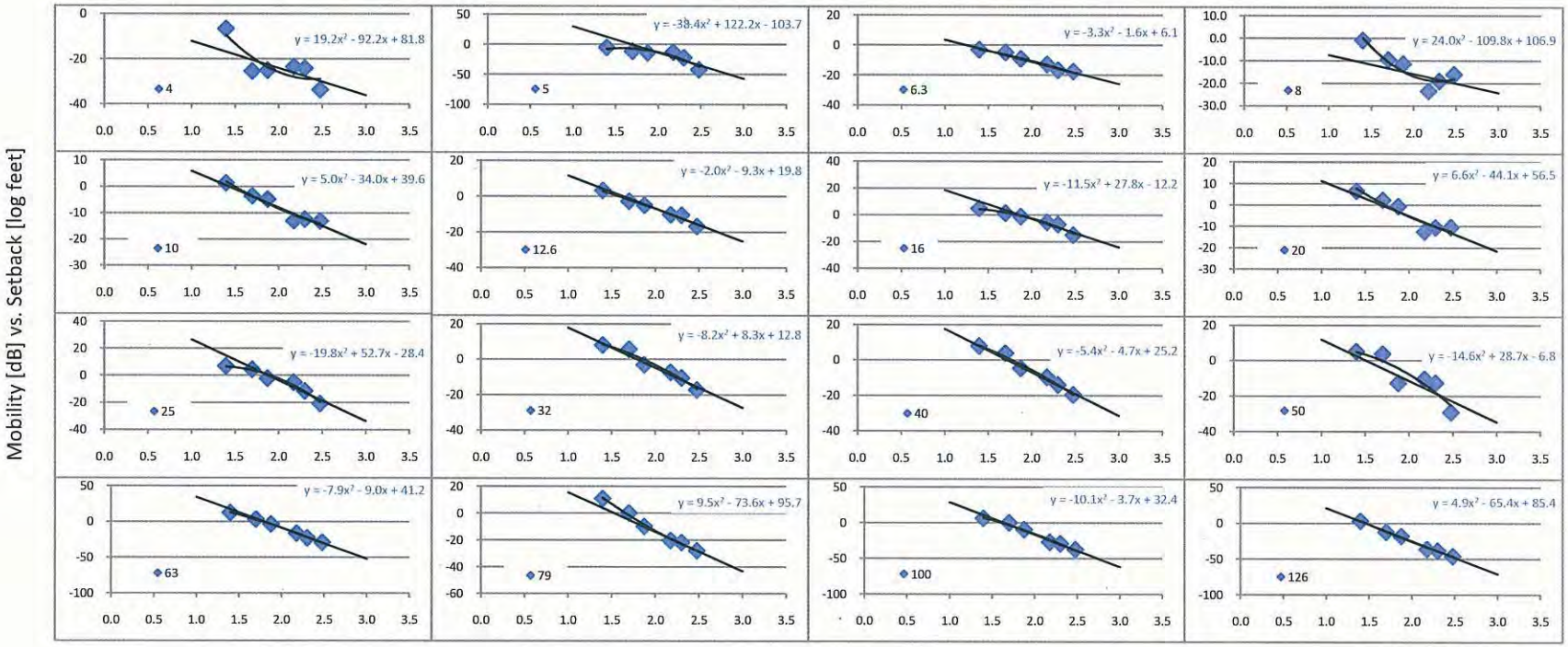
Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
E.1	25	1.4	-6.6	-4.9	-3.2	-0.9	1.3	3.3	4.8	6.4	6.9	8.0	7.8	5.1	12.8	11.0	6.1	3.4
	50	1.7	-25.4	-11.4	-5.0	-9.5	-3.6	-2.8	1.3	2.2	4.4	5.6	3.7	3.7	3.5	0.2	0.0	-12.0
	75	1.9	-25.0	-13.8	-9.2	-11.4	-4.9	-5.0	-1.2	-0.7	-2.2	-3.2	-4.8	-12.8	-3.1	-9.9	-9.6	-17.8
	150	2.2	-23.5	-12.7	-12.8	-23.5	-13.1	-10.2	-5.5	-12.6	-5.1	-7.4	-9.8	-10.5	-16.1	-20.4	-27.0	-36.0
	200	2.3	-24.2	-22.0	-16.7	-19.1	-12.5	-10.5	-7.1	-10.5	-11.5	-10.6	-14.1	-12.8	-22.6	-21.8	-29.2	-38.2
	300	2.5	-33.7	-41.8	-17.5	-16.1	-13.2	-16.8	-14.9	-10.4	-20.9	-17.3	-19.7	-29.2	-29.0	-28.0	-37.2	-45.9
		r^2	**-20.5**	**-26.6**	**-30.6**	**-22.8**	**-8.6**	**-23.3**	**-19.0**	**-33.2**	**-53.3**	**-66.3**	**-33.6**	**-37.3**	**-54.8**	**-40.5**	**-11.5**	**57.3**
		r^1	**59.8**	**89.7**	**109.2**	**80.6**	**25.2**	**83.5**	**66.5**	**120.5**	**197.8**	**238.8**	**97.5**	**92.6**	**162.9**	**90.5**	**-24.1**	**-283.3**
		r^0	**-52.3**	**-78.6**	**-102.8**	**-79.2**	**-24.5**	**-79.7**	**-59.8**	**-108.3**	**-179.8**	**-206.9**	**-57.2**	**-35.2**	**-110.3**	**-29.5**	**70.8**	**305.6**



Appendix B: Background PSR data used to develop LSRs

Series	r	log(r)	4	5	6.3	8	10	12.6	16	20	25	32	40	50	63	79	100	126
E.2	25	1.4	-11.6	-10.0	-5.2	-0.1	2.6	3.3	3.7	6.3	7.2	8.0	7.8	5.0	12.8	10.8	4.1	3.3
	50	1.7	-14.8	-14.3	-13.7	-5.9	-5.0	-2.3	-1.2	0.2	2.7	3.5	1.6	0.2	-4.7	-3.5	-8.4	-14.9
	75	1.9	-16.9	-14.8	-14.9	-6.4	-5.1	-4.3	-2.4	-0.5	-0.3	0.0	-4.2	-6.7	-3.0	-6.2	-11.9	-16.4
	100	2.0	-18.9	-12.4	-14.1	-8.2	-8.7	-10.3	-11.5	-10.1	-12.5	-14.3	-6.1	-13.2	-13.5	-12.1	-20.0	-23.0
	150	2.2	-18.1	-24.8	-25.1	-16.0	-9.7	-9.7	-8.9	-8.6	-8.3	-11.3	-12.4	-10.5	-13.4	-17.2	-27.6	-32.3
	250	2.4	-20.8	-23.4	-26.0	-15.3	-11.6	-12.7	-13.7	-12.3	-17.4	-17.6	-16.0	-19.4	-21.0	-26.5	-35.2	-35.4
	390	2.6	-38.4	-36.7	-33.2	-25.0	-23.9	-24.0	-25.7	-22.0	-32.2	-25.9	-28.8	-40.5	-45.3	-46.6	-54.0	-47.0
		r^2	**-13.0**	**-19.9**	**-11.9**	**-4.9**	**2.8**	**-4.3**	**-2.8**	**-11.0**	**-21.3**	**-35.9**	**-26.4**	**-44.8**	**-50.0**	**-53.9**	**-19.3**	**31.8**
		r^1	**27.4**	**61.0**	**29.4**	**3.9**	**-23.5**	**2.4**	**-2.6**	**25.8**	**61.3**	**109.4**	**66.8**	**124.4**	**142.6**	**147.8**	**9.1**	**-174.6**
		r^0	**-18.3**	**-48.4**	**-18.8**	**1.5**	**26.8**	**5.7**	**12.9**	**-8.5**	**-36.1**	**-70.7**	**-25.0**	**-68.7**	**-88.9**	**-89.8**	**35.9**	**191.1**

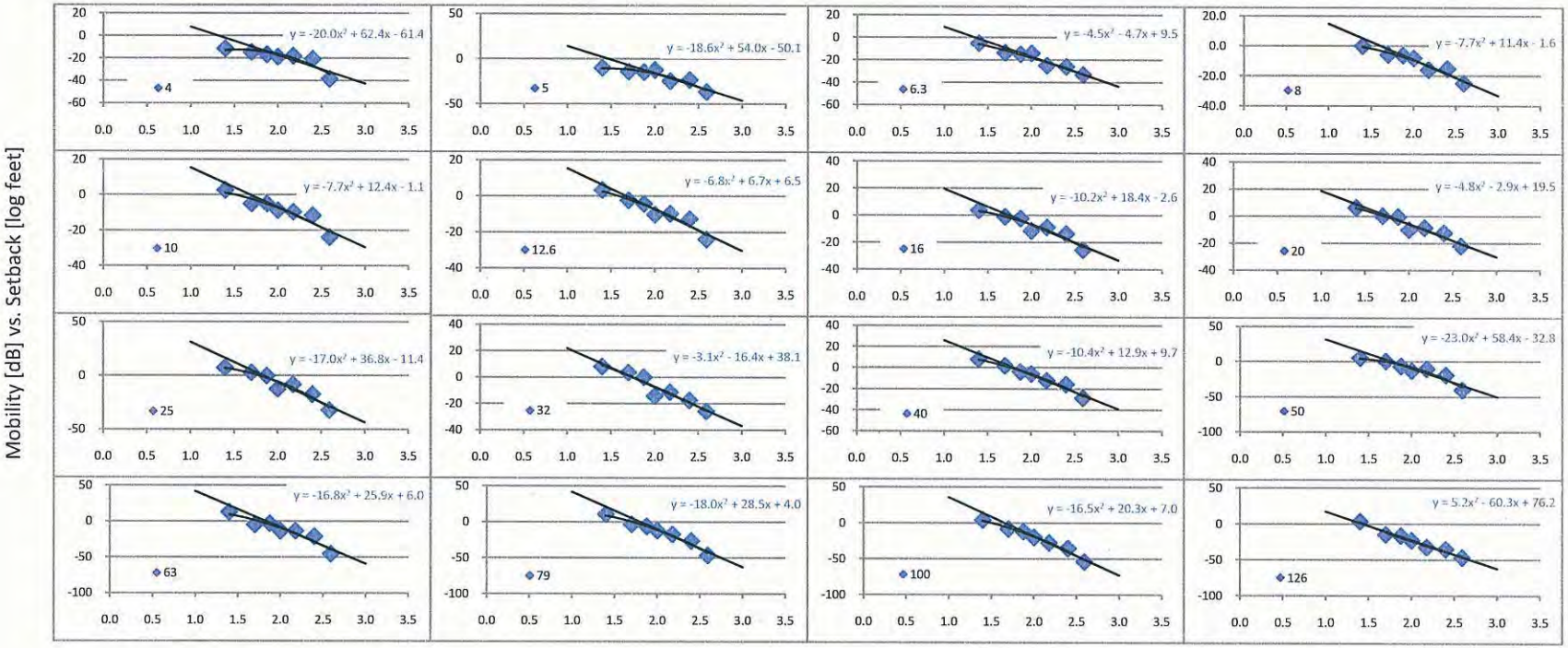


TABLE OF CONTENTS

Survey of Ambient Magnetic Fields on the University of Maryland Campus

Prepared for

John Brandon & Associates

By

T. Dan Bracken, Inc.

Portland, Oregon

September 26, 2008

EXECUTIVE SUMMARY

In order to characterize ambient background magnetic-field fluctuations, static field measurements were performed at 22 locations on the University of Maryland (UMD) campus from July 15-17, 2008. Measurement sites were selected by UMD personnel to be in or near buildings where existing or current research might be impacted by magnetic fields from the proposed Purple Line light-rail system through the campus. Measurements were conducted at 5 indoor and 17 outdoor sites. Ninety minutes of data were collected at most sites. This report describes the results of those measurements and their implications for assessment of impacts on the magnetic field environment from the proposed light-rail system.

Background magnetic-field fluctuations were characterized as **short-term**, lasting from a few to tens of seconds, and **instantaneous**, occurring in less than a second. The proposed light-rail system would also contribute short-term magnetic-field variation to the environment along the route. The short-term variations in the magnetic field from the proposed light-rail system are of concern for interference with susceptible instruments, such as electron microscopes and magnetic resonance spectrometers. The exact levels of the magnetic field from the light rail system cannot be estimated until its design and operating characteristics are known. However, the background short-term fluctuations establish bases for comparing with predicted fields from the train (when available) and for assessing impact from those fields.

The estimated short-term ambient field fluctuations at 18 building or outdoor locations are shown in Table 1, where the results from multiple sites at a building have been combined. Measurements indicated that the fluctuations at a site ranged from 0.05 to 2.0 mG peak-to peak (p-p) with a median of 0.15 mG p-p across all sites. The level of short-term fluctuations varied between sites, with the lowest level at a site near Ludwig Field and the highest level at a site adjacent to H. J. Patterson Hall which was near a bus turnout on Campus Drive. Generally, the highest background fluctuation levels occurred at sites near heavily traveled Campus Drive. At these locations movement of large vehicles perturbs the geomagnetic field and causes fluctuations at nearby locations. Instantaneous variations ranged from 0.02 to 0.50 mG p-p with median of 0.05 mG p-p.

Most building locations (15 of 18) had fluctuations levels of 0.2 mG or less. These levels represent a quiet magnetic field environment compatible with installation of most susceptible research instruments. However, proposed locations for susceptible instruments must be individually evaluated for a multitude of environmental factors prior to installation. The most sensitive instruments to magnetic field fluctuations have siting specifications of 0.1 – 0.2 mG p-p and might require local mitigation, such as field cancellation, to minimize the existing magnetic-field fluctuations. Instrumentation with less stringent magnetic-field siting criteria (> 0.2 mG) may not require such mitigation in the existing magnetic field environments.

A light-rail system with a typical unmodified electrical traction propulsion system can produce magnetic field fluctuations exceeding the typical background levels at the University of Maryland for distances of many hundreds of feet from the tracks. Such an area on campus includes many buildings along both proposed routes where research facilities exist or are planned. The extent of the affected area and the potential for interference with research instruments will depend on the electrical design, physical design and operating characteristics of the light-rail system. The same factors will determine the potential for interference if a field-reduction scheme is incorporated into the light-rail design.

Passage of a train or other large vehicle containing ferromagnetic material perturbs the local magnetic field. Fluctuations due to this perturbation cannot be mitigated and based on

measurements of comparable light-rail vehicles, may exceed 0.1 and 0.2 mG background levels out to approximately 300 and 200 feet, respectively.

Table 1: Current Magnetic Field Fluctuation Levels by Location on University of Maryland College Park Campus. Current levels are maximum peak-to-peak fluctuation in milligauss (mG) based on the measurements of existing background fields.

Site	Building	Current Level, mG	Distance to Alignment*, ft	
			Preinkert/Chapel Drive	Campus Drive
1, 2, 3	Marie Mount Hall	0.1	35	690
4	G. L. Martin Hall	0.15	980	410
5	Mathematics Bldg.	0.3	970	340
6	Physics Building	0.2	950	240
7	Geology Building	0.25	1130	130
8	A. V. Williams Bldg.	0.2	1660	1370
9a, b	Cyclotron Bldg. (Physics)	0.1	1130	440
10	Chemistry Bldg.	0.2	1320	620
11	Plant Sciences Bldg.	0.15	1300	390
12	Microbiology Bldg.	0.2	1290	90
13	Biology-Psychology Bldg.	0.15	1490	370
14	Patuxent Building	1.5	1540	380
15	Physical Sciences Building site	0.2	1840	1000
16, 17	Kim Building	0.15	1740	1260
18	Lefrak Hall	0.2	25	1320
19	H. J. Patterson Hall	2.0	930	50
20	Chapel Field	0.1	240	780
21	Ludwig Field	0.05	980	70

* Approximate distance from nearest track to nearest wall of building.

1.0 INTRODUCTION

The Maryland Transit Administration proposes to build a light-rail system in Maryland along a route passing through the campus of the University of Maryland (UMD) in College Park, MD. The proposed light-rail Purple Line will pass near several existing and proposed buildings where facilities susceptible to changes in magnetic field and vibration are, or will be, housed. The purpose of the measurements described here was to characterize the background level of variation in static magnetic fields at several locations on the UMD campus.

Operation of a light-rail system produces fields that add vectorially to the geomagnetic and other existing magnetic fields. Information on existing background field variation is useful for establishing field criteria for research spaces and developing magnetic-field mitigation strategies. High-resolution 0.01 milligauss (mG) [0.01 mG = 1 nanotesla (nT)] static magnetic field measurements were made at 22 locations on the UMD campus. These measurements are described here and compared to thresholds for interference with selected laboratory and research instruments.

2.0 METHODS

2.1 Instrumentation

Magnetic fields were measured and recorded with two MEDA Model FVM-400 Vector Magnetometers (Macintyre Electronic Design Associates, Inc., Dulles, VA). This handheld magnetometer employs a separate three-axis fluxgate sensor with a sensitivity of 0.01 mG (1 nT). The magnetometer measures the magnetic field sensed in each of the three perpendicular directions and combines them to produce the total (or resultant) field. The resultant geomagnetic field on the campus is approximately 550 mG or 0.55 G. Each instrument was calibrated by the manufacturer within the last six months. A portable field generating coil was used to verify response of the magnetometers to a known magnetic field prior to deployment for measurements.

Two data acquisition systems were used to record data. At locations where electrical power was readily available magnetic field data were recorded with a laptop personal computer (PC) using

the FVM software provided by the magnetometer manufacturer. In instances where battery operation was required, data were processed with a battery-powered single-board computer and stored on a USB memory stick. Communication with the battery powered magnetometer and data logging system was via a wireless communication link from a PC.

Both systems recorded the measured magnetic field at 0.1-second intervals. The use of this sampling interval was based on previous experience of using the fasted sampling rate (10 samples/second) allowed by the manufacturer's software. However, the MEDA instrument does not update its storage buffer at this rate when recording to a remote computer. Instead the maximum rate for this mode of operation is about 2.5 times per second. Consequently, every fourth recorded measurement was selected to yield a 0.4-second interval for analyses.

The fluxgate sensor was connected to the magnetometer with a 2-meter cable. Depending on location the sensor was placed on a work surface or on the ground in a small foam-filled plastic box to minimize rapid changes in temperature and vibration. To the extent practical, the probe was aligned with the x-axis in the north-south direction and with the y-axis in the east-west direction. The z-axis of the probe was vertical.

2.2 Measurement locations

Buildings and general locations where static field measurements were deemed desirable were provided by UMD personnel. Locations were often selected based on the possibility of sensitive research instruments being present in or planned for the nearby building. Specific measurement sites were selected by the investigators taking into account the presence of vehicular traffic, foot traffic and security. If practical, the site was selected at the outside building wall closest to the nearest proposed light-rail alignment. The measurement locations are described briefly in Table 2 and shown in photographs and sketches in Appendices A and B, respectively.

2.3 Data collection

The static magnetic field measurements were conducted at 22 locations over three days from Tuesday, July 15 to Thursday, July 17, 2008 by T. Dan Bracken and Russell S. Senior. Often two measurement systems were deployed simultaneously. Measurements were collected at 17

outdoor and five indoor campus locations. Data were collected for sampling periods from 19 to 98 minutes, with most periods lasting about 90 minutes.

Measurement locations were visited between 8 am and 6 pm. These observations provide an indication of what could be expected at the various locations during daytime hours, when field variation is usually the highest. Generally fields are less variable during early morning hours when human activity is reduced both indoors and out. The locations and times of data collection are listed in Table 2. Measurement locations are shown on a campus map in Figure 1.

The total and component magnetic-field data were recorded in ASCII format with a Greenwich Mean Time stamp, with one record for each measurement. When using the FVM software and a laptop computer for data acquisition a new archive was created after each 3600 records (six-minutes at a 0.1-second sampling rate). In these cases, the archives were concatenated and imported into Excel or SigmaPlot software for analysis and plotting. When a battery operated single board computer data was used for data acquisition, data were recorded in a single archive for the entire measurement period and imported directly into the analysis software.

2.4 Field characterization

The field changes of concern from light-rail systems occur over the 5 to 20 second period that it takes a train to pass a location along the route. The duration of a detectable field change will depend on the speed of the train and the distance from the train. To compare background field variations with those expected from the light rail system, the measured field variations were categorized as follows:

- Instantaneous variation represents the measurement-to-measurement variation seen in the five-minute plots. These field changes represent the noise level for the detection of field changes from the light-rail system. Instantaneous variation was estimated from visual assessment of the 5-minute plots of the data.

- Short-term variation represents the range of field changes seen over periods of seconds to a minute. Infrequent large field changes, such as from movement of a nearby elevator, were

not considered in the determination of short-term variation. Short-term variation was characterized from the 5- and 90-minute time plots. Field changes due to passage of a train would also occur over a period of seconds to tens of seconds. Therefore ambient short-term background fluctuations can be characterized as the background level against which field changes from the train should be compared.

- Long-term variation represents the range of values seen over periods of hours or even a day. Data collected over a 90-minute period will not capture such changes. However, long-term changes in field levels will not be mistaken for fields from the light-rail system and are unlikely to impact susceptible instruments.

2.5 Data analysis

The raw data (0.1-second interval) from each site were plotted and visually inspected to confirm meter performance during data collection. Every fourth measurement from the raw data for each site was extracted to produce the final data set (0.4-second interval) used in analyses. Approximately 30 seconds of data were excluded from analysis at the beginning and end of the data collection period. This exclusion was intended to eliminate possible perturbation of the field by movement of observers near the meter.

The field changes at 0.4-second intervals relative to field at the start of analysis were computed for each component and for the total field over a measurement period. The use of relative fields characterizes the field changes that are of interest to assess potential interference and facilitates interpretation and plotting of the time-series data. The relative fields were plotted versus time to give an indication of temporal variability for comparison with the sensitivity of selected research instruments to variations in the magnetic fields.

Time-series plots over a 5-minute period demonstrated the instantaneous measurement-to-measurement variation and the variations over 5 to 20 second periods. The latter short-term periods are similar to those associated with changes in field from a passing light-rail train.

Field plots over the entire measurement period of usually 90 minutes can also be used to estimate short-term variations as well as show the relative stability of the background field during daytime hours. The magnitude of variations for the x, y and z components and total field are shown in plots of data collected over the 5-minute periods. For longer time periods only the total field is shown. The magnetic-field (vertical) scales vary from plot to plot to accommodate different maximum field changes.

2.6 Field fluctuation analysis

The frequency and magnitude of existing field changes at locations on the UMD campus were estimated with two methods. The first employed visual inspections of the 5-minute and 90-minute measured field plots for each site to estimate the magnitude of the instantaneous and short-term field variations that lasted for less than few seconds to tens of seconds. The data collection periods were too short to reliably characterize long-term variations in background fields that occur over hours or within a day. The instantaneous field variation assigned at each site was based on the observed measurement-to-measurement variation observed during the 5-minute field plots. The short-term variation assigned to a site was based on the largest observed peak-to-peak excursions that occurred several or many times during a full measurement period. These subjective estimates provided a rough quantification of the magnitude of background field variation at a site. The values in Table 1 of the Executive Summary were based on the visual assessment method.

The second, more quantitative, method for estimating ambient field fluctuations used the maximum measured peak-to-peak (pp) field fluctuations during successive 20-second intervals over a measurement period. Twenty seconds is the approximate duration of field fluctuations due to a passing train. The analysis yielded three peak-peak field values per minute and 3N total observations for a measurement period lasting N minutes: typically N≈90, or ~270 observations. The distribution of these fluctuations by magnitude provided an estimate of how often fluctuations of a given amplitude occurred. The larger the amplitude of the fluctuation, the longer the average interval between occurrences. We used the 67^{th} , 90^{th} and 95^{th} percentiles of the maximum 20-second peak-to-peak (20-pp) fluctuations over a measurement period to estimate the fluctuation level that is exceeded on average every 1, 3.3 and 6.7 minutes,

respectively. The 95th percentile background level would be comparable in frequency to the fluctuations of trains passing with 6.7 minute headway. The summary measures were computed for the measured data at each of the 22 sites.

The existing background levels estimated from either method can be compared with siting specifications for various instruments and ultimately can be compared with predicted fields from light-rail trains at a specific site.

2.7 Magnetic-field interference thresholds for susceptible instruments

Very-slowly varying magnetic fields from light-rail systems and moving ferromagnetic objects such as elevators and vehicles can interfere with the operation of scientific instruments that utilize charged beams, such as electron microscopes, electron beam lithography systems, and focused ion beams, and with systems that require a very stable magnetic field, such as magnetic field imaging devices and magnetic resonance spectrometers. Consequently, manufacturers of such devices often provide siting specifications for allowable field levels or for distances to be maintained between susceptible instruments and sources of magnetic field. The dc magnetic-field siting specifications for selected instruments are listed in Table 3 for comparison with the background levels reported here.

As shown in Table 3 the field stability requirements for some of the charged-beam apparatus are at levels of 0.1 mG. If background field fluctuations exceed this level then mitigation to reduce the fluctuations will likely be required before installation of such apparatus. Charged-beam apparatus generally require a small enough stable-field volume that field mitigation can be achieved either by modifying the source and/or introducing field cancellation or shielding at the receiver.

Nuclear magnetic resonance (NMR) spectrometers require a very stable magnetic field to operate. This is usually provided by a large superconducting magnet. Trains from a light-rail system can introduce slight variations in this field and interfere with sensitive measurements.

Thresholds for interference with NMR spectrometers have been established by researchers when considering the effects of light-rail systems on their research. For example, researchers at the University of Washington Chemistry Department established a threshold of 0.1 mG (total field) for their spectrometers and researchers at the Washington University (St. Louis) Chemistry Department established a threshold for interference of 0.02 mG (vertical field) inside the NMR spectrometers. This latter threshold assumed the superconducting magnet provided attenuation by a factor of five. The field inside the magnet is also affected by the time constant for penetration of the changing fields into the magnet. These two thresholds are similar but not quite equivalent, since the 0.1 mG is the total field and the internal 0.02 mG refers to an attenuated vertical field inside the magnet.

According to a vendor of commercial field cancellation systems their use to mitigate field fluctuations near NMR systems is problematic and not recommended.

3.0 RESULTS

3.1 Geomagnetic field

The average total magnetic field at 17 outside locations was 0.503 ± 0.056 G and the average at five indoor locations was 0.398 ± 0.175 G. The difference between the magnitude and variability of outside and inside mean levels can be attributed to shielding and field enhancement by ferromagnetic material, typically steel, in the building structures.

3.2 Data quality

The initial inspection of the raw data field plots indicated that the instruments and data collection protocols performed reliably with two minor exceptions. Sites 4 and 11 exhibited abrupt instantaneous unidirectional changes in the field components without a corresponding change in the total field. These were attributed to inadvertent reorientation of the field sensors, possibly by a squirrel or the observer. These abrupt changes did not occur during the 5-minute plots that include all components, but were included in the 90-minute plot, since the total field measurements were not compromised by a change in sensor orientation.

Contemporaneous abrupt unidirectional changes in the components and total field were also noted at Sites 2, 14, 16 and 21. These were attributed to the movement of nearby ferromagnetic objects: most likely elevators at Sites 2, 14 and 16 and a vehicle at Site 21.

The inspections also indicated that the sampling rate changed unexplainedly from 0.1-second intervals to approximately 30-second intervals in the last 51 minutes of measurements at Site 19 (H. J. Patterson Hall). Therefore only the first 39 minutes at the faster sampling rate were analyzed for Site 19. The magnetometer functioned without problems in the next deployment.

3.3 Field variation

Time-series plots of the field magnitude at each measurement location for the first 5-minute period and over the approximate duration of measurements are given in Figures 2 – 24. The levels of short-term field variation that were estimated from visual inspection at the 22 sites are listed in Table 1 of the Executive Summary.

The estimated short-term field variation ranged from 0.05 mG at Ludwig Field to 2.0 mG at H.J. Patterson Hall near a Campus Drive bus turnout. The quietest indoor sites were near the shielded room in the MEG lab and in the susceptibility lab in the Physics Bldg. All but two of the measurement locations had estimated short-term variation of less than 0.3 mG p-p. Given the capability of active field-cancellation systems and their expanding incorporation into installations of sensitive instrument, all the locations with background levels less than 0.3 mG are currently suitable for siting sensitive instruments.

The estimated instantaneous field variations varied from 0.02 to about 0.5 mg, with the largest at the site near H. J. Patterson Hall. All but three sites had instantaneous field changes of 0.05 mG or less. The 0.1 mG instantaneous levels in the Fabrication Laboratory in the Kim Building are probably from a local source that can be identified and mitigated.

The magnitude and frequency of short-term field fluctuations estimated from the distributions of maximum p-p changes in 20-second intervals are given in Table 4 for comparison with those estimated from visual assessments. The 67th, 90th and 95th percentiles of the 20-second interval

maximum p-p fluctuations along with those from visual assessments are plotted in Figure 25 for all sites.

As seen in Table 4 and Figure 25, the 90th percentile (1/3.3 minutes) and 95th percentile (1/6.7 minute) of the maximum 20-second p-p fluctuations were very similar to those estimated with a visual assessment. The fluctuation magnitudes for all but two sites were less than about 0.3 mG by all measures. The median fluctuation levels across sites were 0.18, 0.13, and 0.17 mG based on the visual assessment, 1/3.3-minute, and 1/6.7-minute measures, respectively. These results suggest that ambient magnetic-field fluctuations range from 0.1 to 0.3 mG with a typical value of about 0.15 mG at existing and future research sites on the UMD campus.

4.0 DISCUSSION

4.1 Measurements

Probe vibration could have contributed to some of the observed instantaneous fluctuations in the field measurements. Sensitivity of the probe to temperature variations could have caused some of the observed drift in magnetic fields, such as that seen at several of the outdoor sites. However, the slow drift does not affect the estimates of instantaneous and short-term field variation.

All of the measurements were collected during daytime hours when local field variation tends to be highest due to vehicular traffic and human activity. However the 90-minute or shorter measurement periods at all sites failed to capture sufficient data to estimate long-term variations and identify any local sporadic or diurnal sources.

4.2 Local sources

Vehicles and elevators are well known local sources of field changes due to perturbation of the geomagnetic field. In some cases, we were able to confirm directly these objects as the source of field excursions from background levels in the recorded data. In other cases the characteristics of the field change and knowledge of the types of sources in the area were sufficient to identify sources. For example, perturbation of the field by a vehicle (or other moving object) is

characterized by a spike of short duration determined by the speed of the vehicle. After the vehicle is out of range of the sensor, the field returns to its original background level. The largest field perturbation occurs in the vertical direction. The only clear examples of vehicle passage are in Figure 23 (Site 21, Ludwig Field). There an automobile arrived at about 2.4 minutes into the measurement period, stopped and then departed two minutes later. The passage of two cars near the measurement site was also seen between the 25th minute and the end of measurements.

Changes in field due to elevator movement are characterized by a step-like increase or decrease in field from one stable background level to another. The step-like field traces in Figures 3 (Site 2: Inside Marie Mount Hall) and possibly those in Figure 16 (Site 14 Patuxent Building) were due to changes in the position of elevators.

In many cases it was not possible to identify the source of a field change. For example, at indoor locations it was often not possible to observe specific activities that occurred in other parts of the building or outside the building. Furthermore when collecting data with the battery operated modules, it was not possible to visually monitor data collection and identify field-change events and sources in real time.

4.3 Data analysis

Two approaches, as described in Section 2.6, were used to estimate the amplitude of ambient magnetic-field fluctuation levels that are comparable in frequency and duration to those produced by a light-rail system. The results from these two approaches were similar, giving credence to the estimated levels of field fluctuations on the UMD campus. At present there is no generally accepted methodology for analyzing field fluctuations for comparison with light-rail generated magnetic fields. If another approach is identified for characterizing fluctuations, then the data reported here can be re-analyzed for comparison with future ambient measurements or with light-rail fields.

4.4 Comparison with siting specifications

The measured background variations at 17 of 22 sites exceeded the 0.01-mG criterion given in Table 3 for siting the most sensitive electron microscopes and NMR spectrometers. The five sites with fields at or below 0.01 mG were two open fields (Chapel Field and Ludwig Field), the MEG laboratory in Marie Mount Hall, a site outside Marie Mount Hall, and the susceptibility laboratory in the Physics Building. The other site outside Marie Mount Hall (Site 1) had field variation of 0.15 mG, while Site 9a in the SQUID laboratory in the Physics Building and Site 6 outside the Physics Building had background field variations of 0.3 and 0.2 mG, respectively. Thus, future installation of instruments on campus with the most stringent siting specifications will most likely require mitigation, even with existing background levels. Other less sensitive instruments may, or may not, require field mitigation.

4.5 Comparison with light-rail system fields

Two sources contribute to the magnetic field from a light-rail system: 1) the propulsion field, B_{prop} due to currents supplying power to the train and 2) the perturbation field, B_{pert}, due to movement of the ferromagnetic material in the train causing perturbation of the earth's field. Normally these two components are computed independently and added to produce the total field. The propulsion field can be reduced by careful design of the circuit supplying power to the train, as was done at Washington University in St. Louis and Bielefeld University in Germany and is planned at the University of Washington in Seattle. The perturbation field can only be reduced by separation from the moving vehicles, by elimination of ferromagnetic materials in the vehicle, or possibly by local field cancellation.

The propulsion field is determined by the physical layout of the conductors and the maximum current drawn by the train. The latter is dependent on the maximum speed of the train, the supply voltage, the grade, the number of passengers and other design and operating factors. Leakage of propulsion current into the earth can also cause magnetic fields unless the system is designed and maintained to ensure sufficient electrical isolation between the tracks and the earth. Until a design and operating conditions are specified it is not possible to predict B_{prop} for the Purple Line light-rail trains.

However, rough estimates of the unmitigated magnetic field at various distances from a light-rail system with electrical traction power current of 1000 amperes (A) are given in Table 4. These estimated levels are intended only to indicate the order of magnitude of fields due to a light-rail system and do not necessarily represent the fields that would occur near the proposed Purple Line system. Mitigation strategies incorporated into the design of the above mentioned systems have reduced the total fields significantly from those shown in Table 4.

If typical background fluctuation levels are assumed to be 0.2 mG, then the fields from the hypothetical light-rail system in Table 4 exceed background levels out to a distance of 200 m (656 ft.) from the tracks, and exceed 2 mG out to 63 m (200 ft.). This example illustrates the potential for unmitigated fields from trains to exceed background levels over extended areas of the campus. As emphasized previously, these field values are not intended to represent the fields from the proposed light-rail system and are for illustrative purposes only. The actual magnitude of fields from the proposed system and the actual impact on potential research activities will depend on the routing of the tracks, and the electrical design and physical configuration of the system.

The perturbation fields have been measured for light-rail cars coasting without propulsion current. At distances from the track less than about 100 m (330 ft), the estimated maximum B_{pert} for a 1-, 2- or 4-car light-rail train at r meters from the track is: $B_{pert} \approx 2000/r^{2.2}$. The perturbation field will drop below 0.2 mG at about 220 feet (67 m) and below 0.1 mG at about 300 feet (91 m) from the train. Estimated perturbation fields are shown in Table 4.

The predicted perturbation fields from the proposed light-rail trains indicate that no mitigation scheme can reduce the total field from the trains to below background levels inside of about 300 feet from the tracks. Marie Mount and Lefrak Halls on the Preinkert/Chapel Drive route and Microbiology, Geology and H. J. Patterson Hall on the Campus Drive route are located within this range.

5.0 CONCLUSIONS

Static-field measurements were performed at 22 locations on the UMD campus. The locations were selected to be in or near buildings where existing or current research might be impacted by magnetic fields from the proposed Purple Line light-rail system through the campus.

The measurement sites often coincided with the closest distance from a building to a well traveled street. This could have resulted in an overestimate of field fluctuation found in more distant points inside the building.

Characteristics of the background magnetic field fluctuations were:

- Short-term variations (seconds to tens of seconds) were between 0.05 to 2.0 mG p-p with most between 0.10 and 0.30 mG and had a median of 0.15 mG p-p;
- Instantaneous variations (< 1 second) ranged from 0.02 to 5.0 mG p-p and had a median of 0.05 mG.
- The maximum field fluctuations occurred adjacent to H. J. Patterson Hall near a bus turnout on Campus Drive.

Future installation of susceptible instrumentation with a siting specification of 0.1 or 0.2 mG p-p for dc fields will most likely require mitigation of background magnetic field fluctuation levels. Instrumentation with less stringent siting criteria (> 0.20 mG for dc fields) may not require such mitigation in the existing magnetic field environment. However, magnetic fields at other frequencies, such as the power frequency of 60 Hz, can also interfere with the performance of susceptible instruments. Thus, magnetic field variation across a range of frequencies must be evaluated to determine the need for mitigation measures at a specific site

A light-rail system with a normal electrical traction propulsion system will produce magnetic fields exceeding the typical background levels over an area that includes existing and planned research buildings. The extent of this area and the potential for interference will depend on the electrical design, physical design and operating characteristics of the light-rail system. The same

factors will determine the potential for interference if a field-reduction scheme is incorporated into the design.

Because of perturbation fields due to movement of the proposed light-rail trains, the total field will exceed background fluctuation levels (0.1 mG) out to about 300 feet (91 m) from the tracks. Beyond that distance the propulsion fields will predominate and the total field will depend on the design of the light-rail system .

Table 2: Magnetic Field Measurement Locations

Site. No.	Location	Start		Minutes of Meas.	Comments
		Day	Hour EDT		
1	Marie Mount Hall: Outside in courtyard at southwest corner of building	7/15	1027	94	
2	MEG laboratory: Inside Marie Mount Hall adjacent to shielded room	7/15	1131	96	Fields in shielded room would be much more stable. Elevator nearby.
3	Marie Mount Hall: Outside against north wall at northeast corner	7/15	1224	91	
4	G. L. Martin Hall: Outside in shrubs just to northeast of front entry	7/15	1411	90	Sensor inadvertently reoriented at 1510 minutes
5	Mathematics Building: Outside in shrubs at southwest corner just east of entry to Mathematics Building	7/15	1430	95	
6	Physics Building: Outside in shrubs just to west of entry	7/15	1601	92	
7	Geology: Outside at southwest corner of building	7/15	1617	91	At corner of Campus and Regents Drive
8	A. V. Williams Bldg: Outside at center of south wall near brick gate	7/16	0828	98	
9a	Physics: SQUID lab: Inside old cyclotron lab on 2nd floor.	7/16	0829	19	
9b	Physics: Inside susceptibility measurements lab near SQUID magnetometer	7/16	0915	19	Opening and closing door to lab caused 0.3 mG change in field
10	Chemistry: Outdoors at north side of entrance courtyard	7/16	1034	91	
11	Plant Sciences: Outdoors between Plant Sciences and Hornbake Library	7/16	1100	91	
12	Microbiology: Outside at southwest corner of building	7/16	1251	92	96 feet to Campus Drive
13	Biology-Psychology: Outside in shrubs to west of main entrance	7/16	1306	93	
14	Patuxent Building: Outside at northeast corner of building to north of steps to patio.	7/16	1426	65	
15	Physical Sciences Building Site: Outside at southeast corner of site	7/16	1450	61	
16	Kim Building: Inside NISP Lab Room, 1237C	7/16	1622	91	JEM 2100F Field Emission Electron Microscope in lab.

Site. No.	Location	Start		Minutes of Meas.	Comments
		Day	Hour EDT		
1	Marie Mount Hall: Outside in courtyard at southwest corner of building	7/15	1027	94	
17	Kim Building: Inside Fab Lab, Room 2310	7/16	1643	61	In clean room near scanning electron microscope and direct-write electron beam.
18	Lefrak Hall: Outside north side of building	7/17	0843	91	Near speech and hearing lab
19	H. J. Patterson Hall: Outside at northwest corner of building	7/17	0903	92	27 feet from Campus Drive. Adjacent to eastbound bus turnout
20	Chapel Field: Outside near center of field	7/17	1052	38	
21	Ludwig Field: Outside at south side of soccer field adjacent to Parking Lot 1d	7/17	1116	31	Vehicle parked near sensor at beginning of measurements

Table 3: Magnetic Field Siting Requirements for Selected Instruments

Type*	Vendor	Model	Threshold Magnetic Field, mG
SEM	JEOL	5200	3.0 mG
SEM	JEOL	JSM 7000F, JSM 7400	0.1 mG, peak-to-peak (p-p)
TEM	JEOL	4000EX	0.1 mG, p-p
TEM	FEI	Tecnai G2 TF20 ST; STEM	0.8 mG, p-p horizontal 1.0 mG, p-p vertical
MRI	Philips	Achieva Quasar Dual 3.0T	11.0 mG, based on 24 m from 750A train
NMR Spect.	Unknown	Univ.. of Wash. Chemistry Dept. Located 310 m from tracks.	0.10 mG, p-p, field threshold not to be exceeded by light-rail system
NMR Spect.	Unknown	Washington Univ. Chemistry Dept. Located 73 m from tracks.	0.02 mG, p-p vertical field inside super-conducting magnet of NMR spect.

SEM = Scanning electron microscope; TEM = Transmission electron microscope;

NMR Spect. = nuclear magnetic resonance spectrometer.

Table 4: Estimated Magnetic Field from an Unmitigated Light-Rail Train with Overhead Power Traction System Operating at 1000 A. *Note: The total fields are for illustrative purposes only and do not necessarily represent fields from the proposed Purple Line light-rail system.*

Distance from Train, feet (m)	Estimated Total Magnetic Field, mG	Perturbation Field, mG
66 (20)	15.3	2.75
164 (50)	2.5	0.37
328 (100)	0.6	0.08
656 (200)	0.2	—

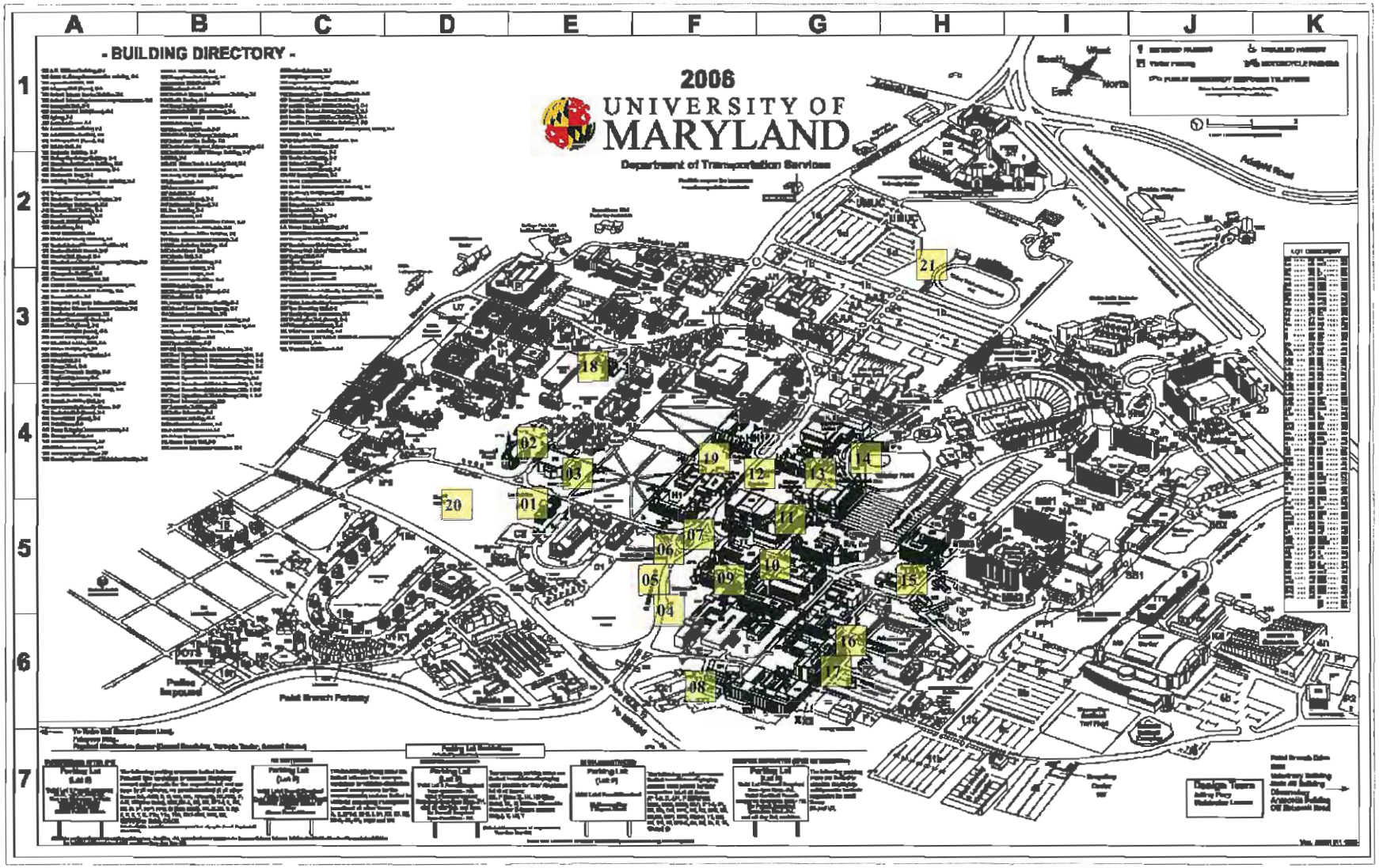
Table 5: Estimated Magnetic Field Variation in Milligauss by Methodology by Measurement Site

Site No.	Location	Visual Assessment, mG		Distribution of 20-second p-p, mG			Comment
		Instan-taneous	Short-term*	95th %ile One/6.7 min.	90th %ile One/3.3 min.	67th %ile One/min.	
1	Marie Mount Hall (Outside)	0.02	0.15	0.1	0.09	0.1	
2	MEG laboratory (Inside) Marie Mount Hall	0.03	0.10	0.23	0.13	0.08	Elevator movement caused field change of about 0.7 mG.
3	Marie Mount Hall (Outside)	0.05	0.10	0.14	0.13	0.09	Drift in field probably due to temperature change of sensor.
4	G. L. Martin Hall (Outside)	0.02	0.15	0.14	0.12	0.08	
5	Mathematics Building (Outside)	0.05	0.30	0.15	0.11	0.08	
6	Physics Building (Outside)	0.05	0.20	0.17	0.14	0.11	
7	Geology Building (Outside)	0.05	0.25	0.19	0.16	0.1	Larger variability could be from traffic on Campus and Regents Drives.
8	A. V. Williams Bldg. (Outside)	0.05	0.20	0.18	0.14	0.09	
9a	Physics Bldg: SQUID lab (Inside)	0.10	0.30	0.29	0.24	0.12	Source of field variations not known.
9b	Physics Bldg: Susceptibility lab (Inside)	0.03	0.10	0.13	0.12	0.09	
10	Chemistry Building (Outside)	0.05	0.20	0.32	0.25	0.18	Large field spike at about 19 minutes attributed to opening/closing of steel door.
11	Plant Sciences Bldg. (Outside)	0.05	0.15	0.13	0.12	0.08	Initial drift could be due to temperature change of probe.
12	Microbiology Bldg. (Outside)	0.05	0.20	0.17	0.14	0.1	Initial drift could be due to temperature change of probe.
13	Biology-Psychology Bldg. (Outside)	0.05	0.15	0.11	0.1	0.07	
14	Patuxent Building (Outside)	0.05	1.50	1.13	0.75	0.11	Sustained field changes probably due to elevator; source of short-term field

Site No.	Location	Visual Assessment, mG		Distribution of 20-second p-p, mG			Comment
		Instan-taneous	Short-term*	95th %ile One/6.7 min.	90th %ile One/3.3 min.	67th %ile One/min.	
1	Marie Mount Hall (Outside)	0.02	0.15	0.1	0.09	0.1	
							changes unknown.
15	Physical Sciences Building site (Outside)	0.05	0.20	0.22	0.2	0.15	Variability could be due to traffic on Stadium and Regents Drives.
16	Kim Building: NISP Lab. (Inside)	0.05	0.15	0.17	0.12	0.05	Drift over first 50 minutes could be temperature related. Source of abrupt change at 55 minutes is unknown.
17	Kim Building: Fab. Lab. (Inside)	0.10	0.15	0.16	0.15	0.14	Source of rapid 0.2-mG field changes along y-axis is not known. Relative change in total field is smaller.
18	Lefrak Hall (Outside)	0.02	0.20	0.1	0.06	0.04	
19	H. J. Patterson Hall (Outside)	0.50	2.0	2.16	1.58	0.85	Large short-term and instantaneous field changes due to traffic through nearby bus turnout
20	Chapel Field (Outside)	0.02	0.10	0.08	0.07	0.05	
21	Ludwig Field (Outside)	0.02	0.05	0.18	0.07	0.04	Least variability observed.

* Visual assessment of short-term variations used in Table 1.

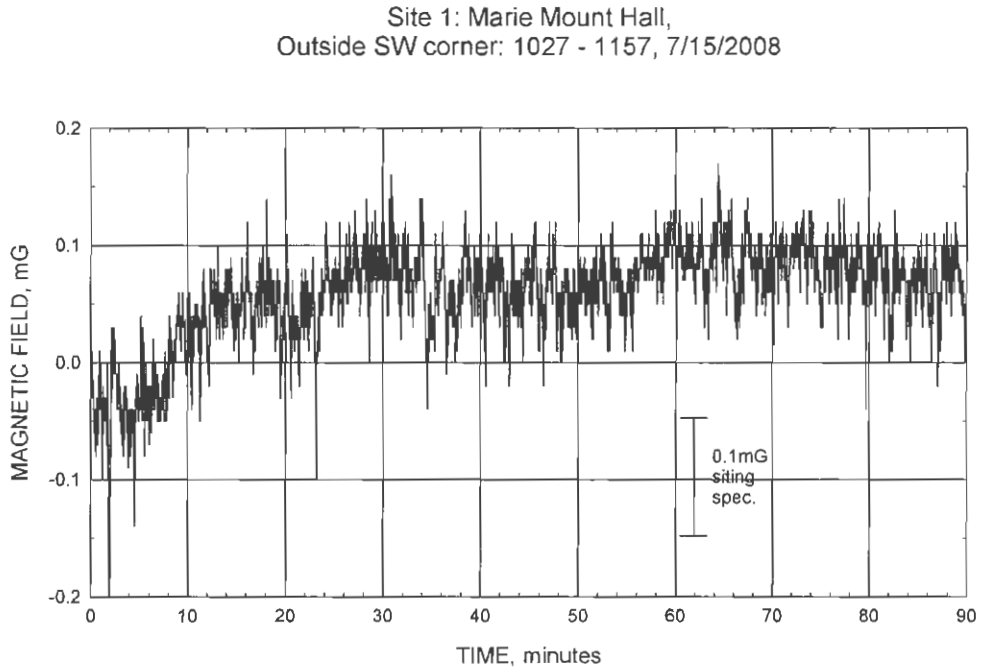
Figure 1: Magnetic-field measurement sites on the University of Maryland campus. (See Key for site description.)



Key for Measurement Sites in Figure 1							
1	Marie Mount: Outside SW corner	7	Geology: Outside SW corner	13	Biology-Psychology: Outside W of entrance	19	H. J. Patterson: Outside NW corner
2	Marie Mount: Inside MEG lab.	8	A. V. Williams: Outside center of S wall	14	Patuxent: Outside NE corner	20	Chapel Field: Outside near center of field
3	Marie Mount: Outside NE corner	9	Physics: Inside a) Squid lab. and b) Susceptibility lab.	15	Physical Sciences building site: Outside at SE corner	21	Soccer Field: Outside at S. side of field adjacent to parking lot 1d
4	G. L. Martin: Outside NE of front entrance	10	Chemistry: Outside in entrance courtyard	16	Kim: Inside NISP lab.		
5	Mathematics: Outside E of entrance	11	Plant Sciences: Outside between bldg. and Hornbake Library	17	Kim: Inside Fab lab.		
6	Physics: Outside W of entrance	12	Microbiology: Outside SW corner	18	Lefrak: Outside N side		

Figure 2: Total magnetic field measurements at Site 1 outside Marie Mount Hall from 1027 to 1157 July 15, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

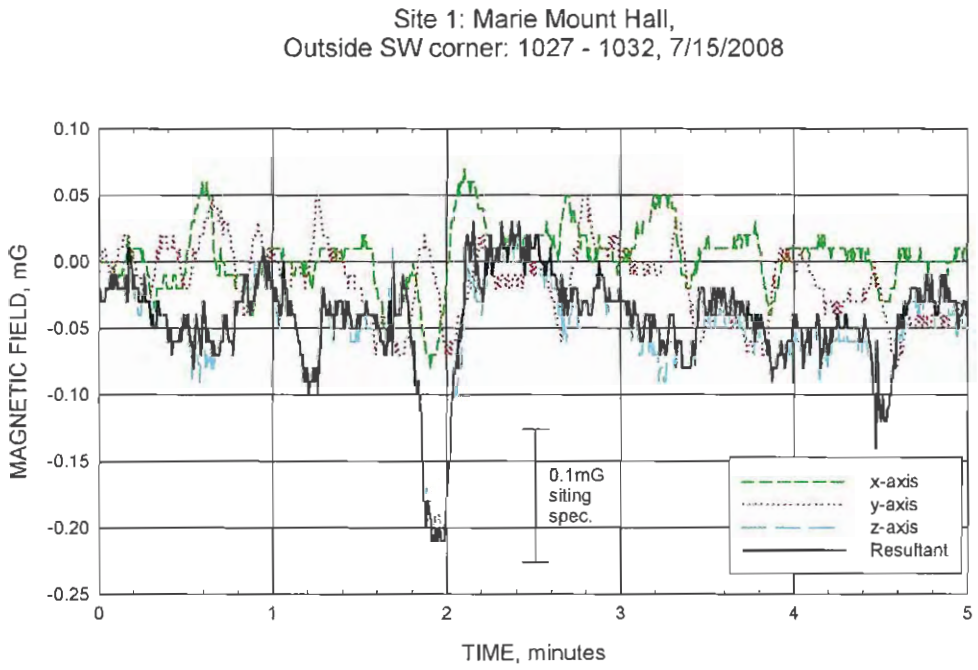
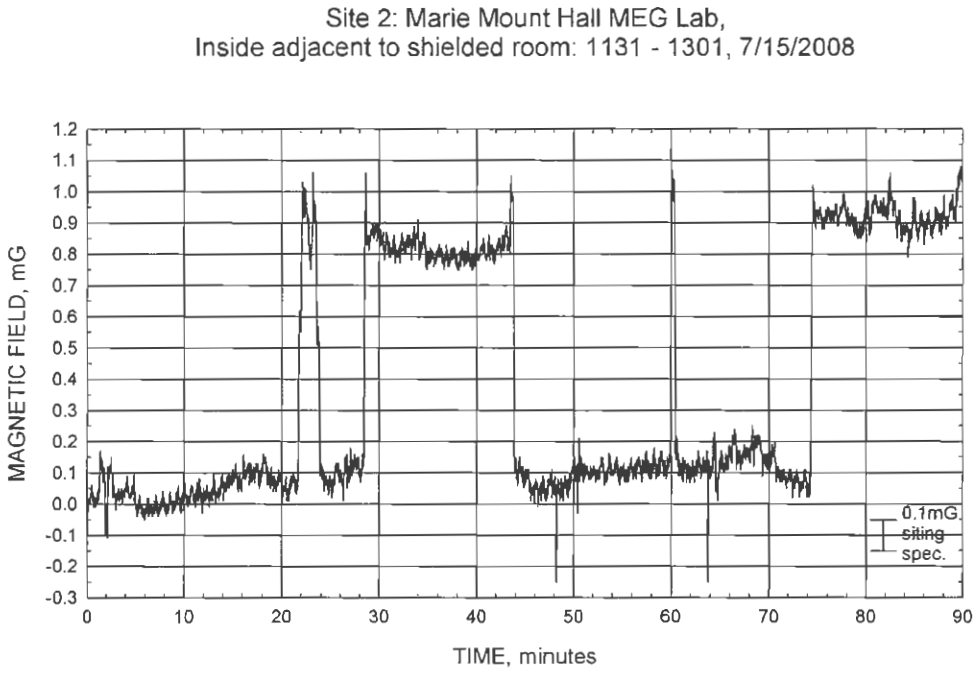


Figure 3: Total magnetic field measurements at Site 2 inside MEG lab in Marie Mount Hall from 1131 to 1301 July 15, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

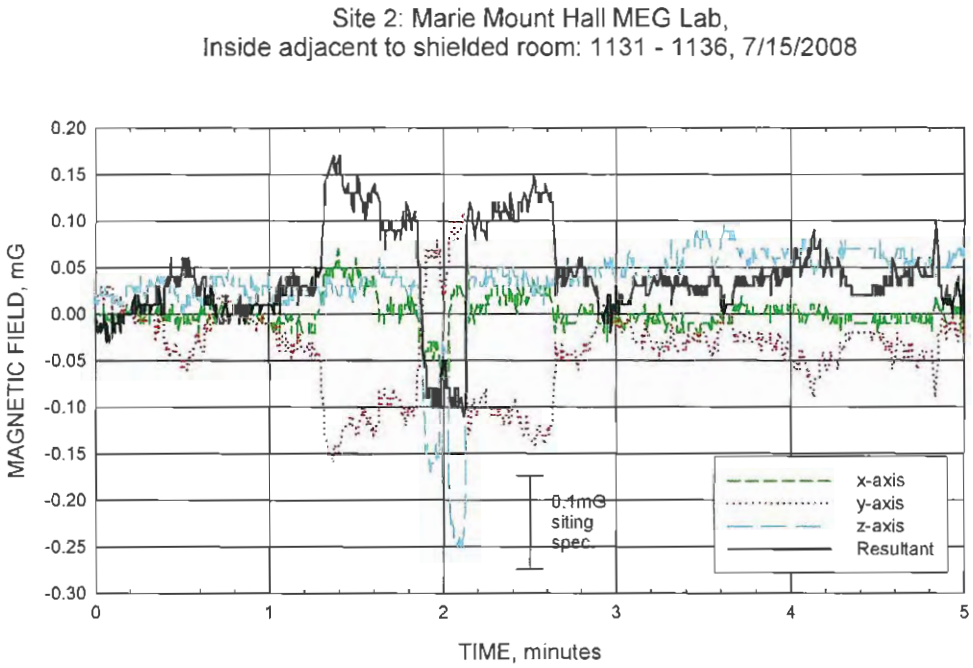
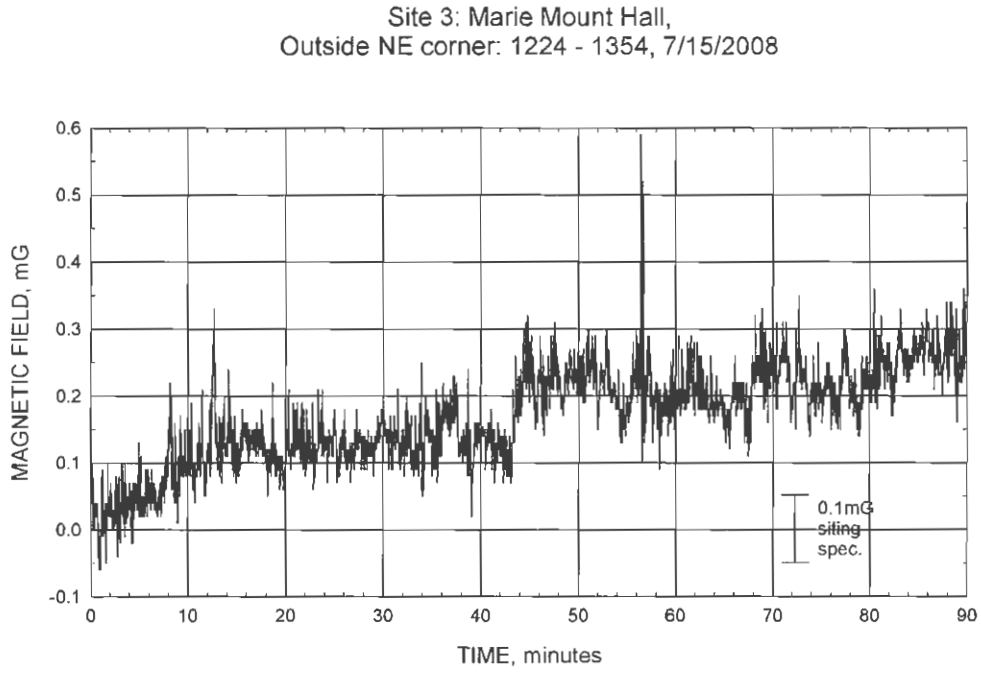


Figure 4: Total magnetic field measurements at Site 3 outside Marie Mount Hall from 1224 to 1354 July 15, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

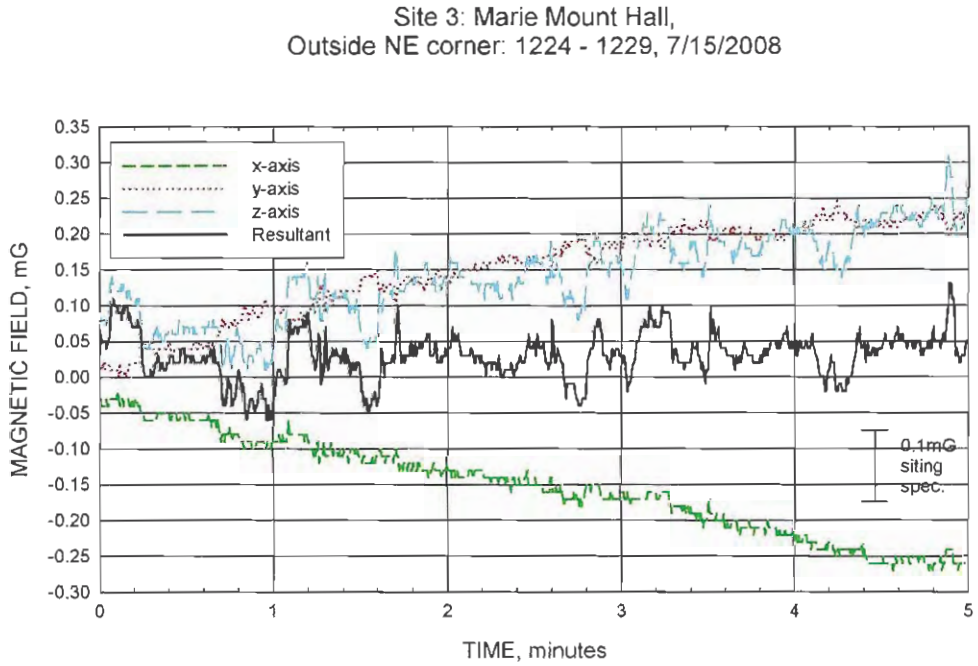
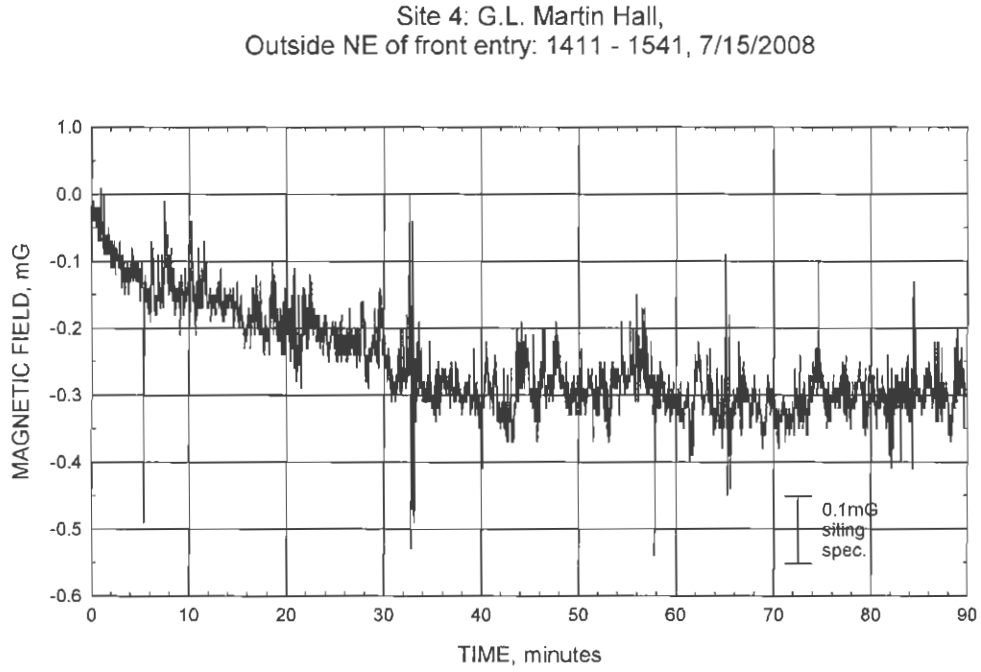


Figure 5: Total magnetic field measurements at Site 4 outside G. L. Martin Hall from 1411 to 1541 July 15, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

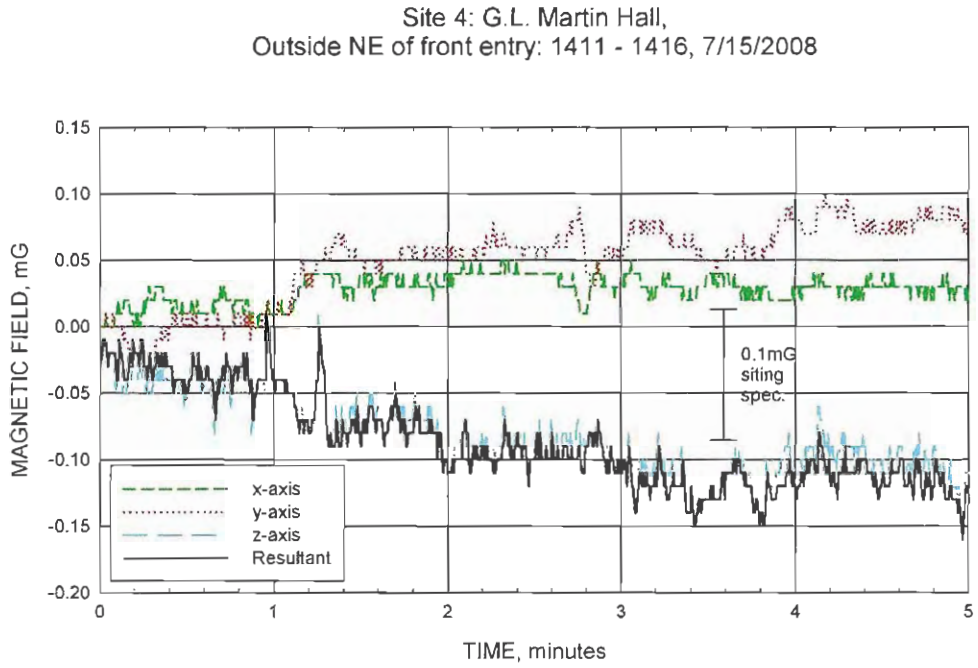
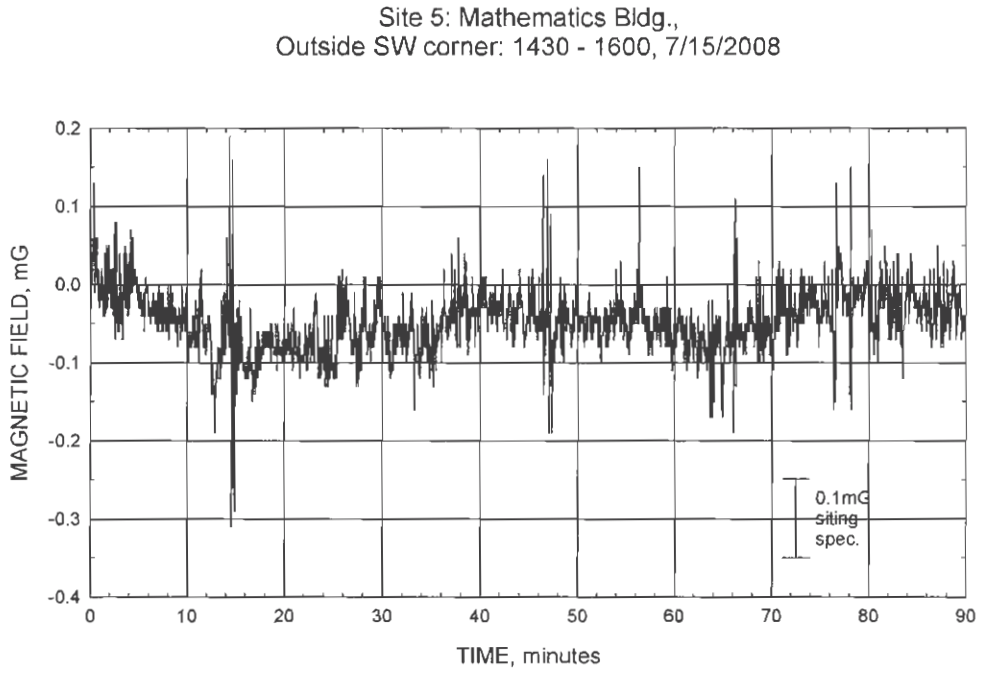


Figure 6: Total magnetic field measurements at Site 5 outside Mathematics Building from 1430 to 1600 July 15, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

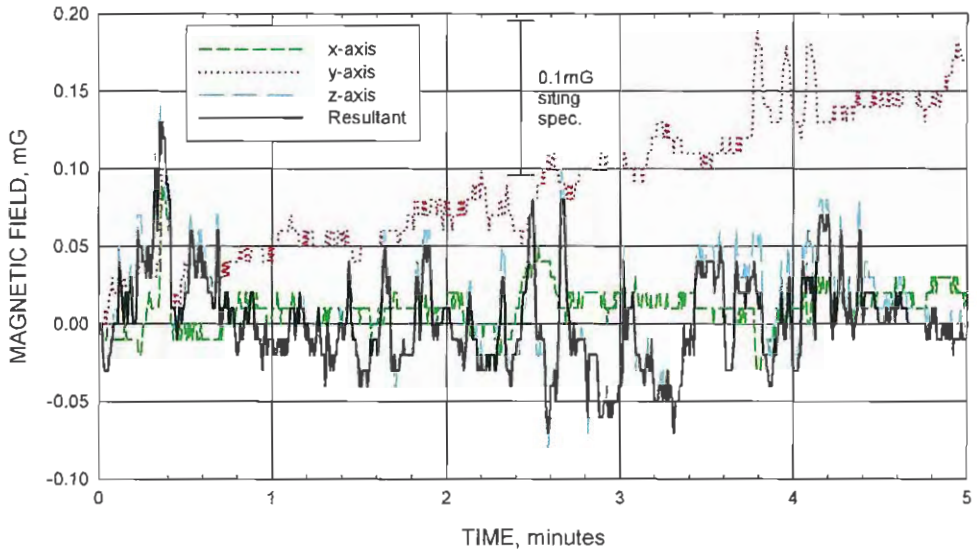
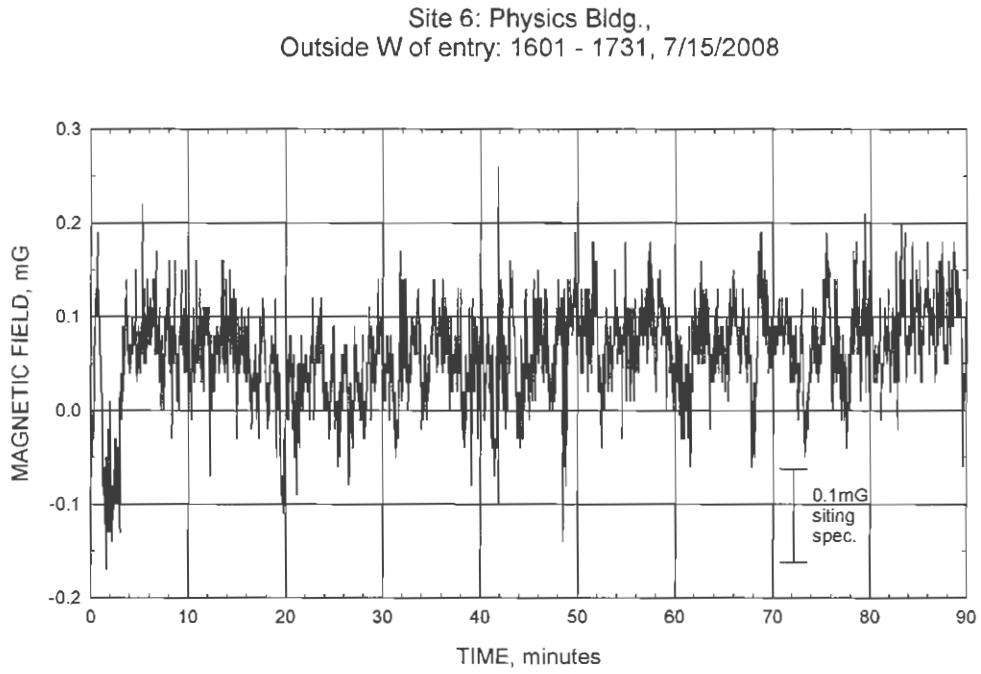


Figure 7: Total magnetic field measurements at Site 6 outside Physics Building from 1601 to 1731 July 15, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

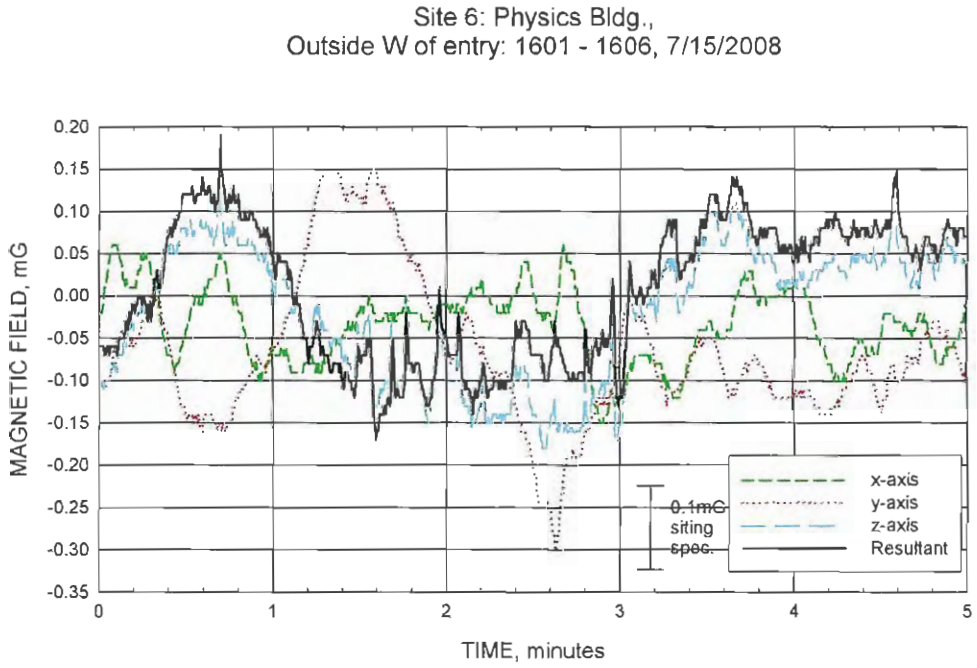
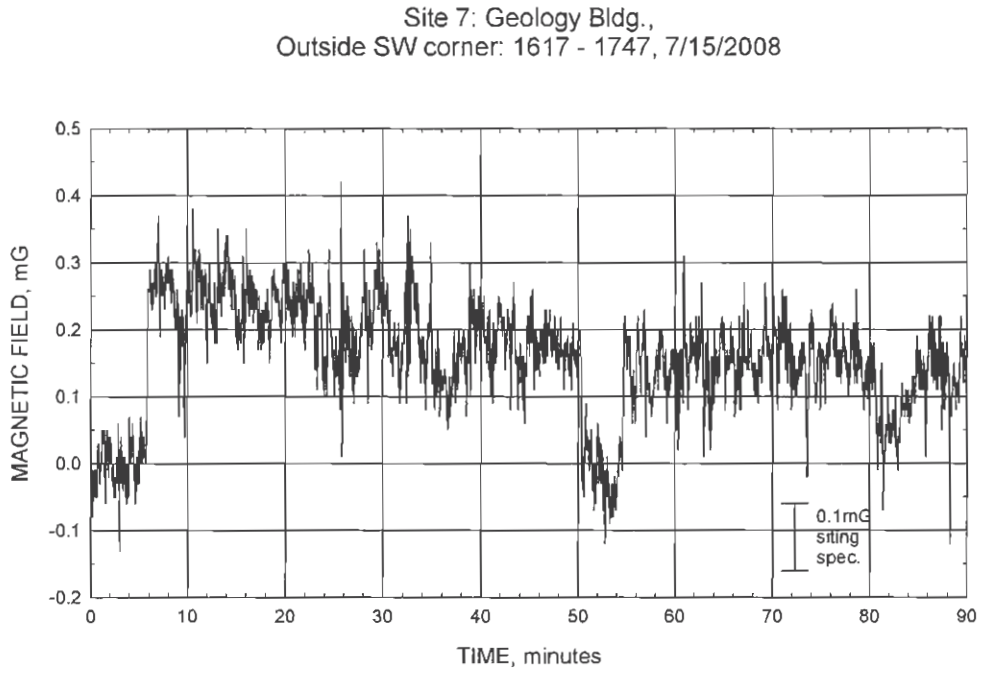


Figure 8: Total magnetic field measurements at Site 7 outside Geology Building from 1617 to 1747 July 15, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

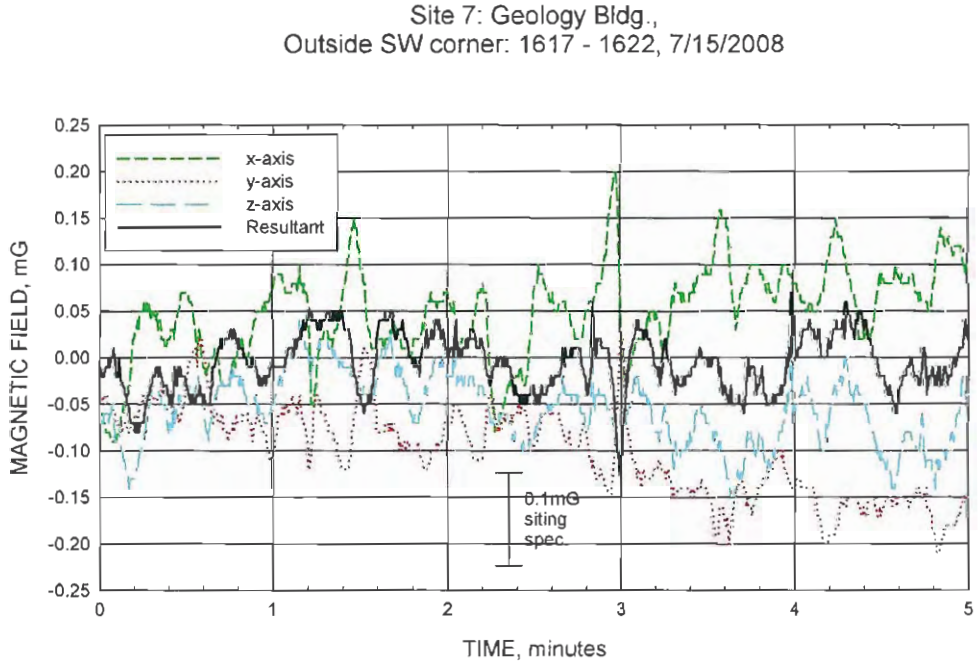
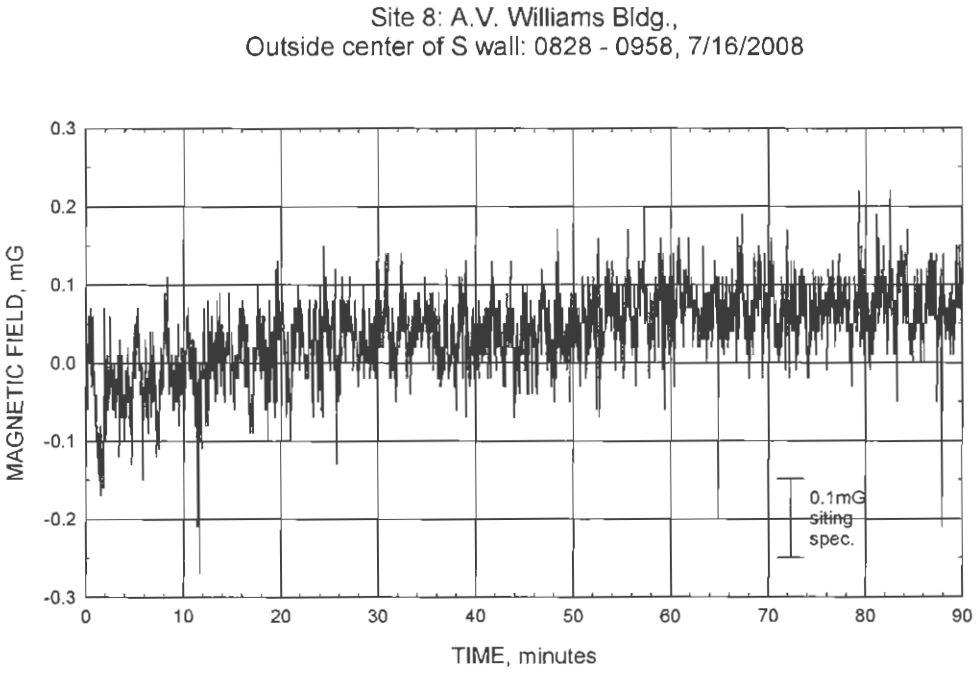


Figure 9: Total magnetic field measurements at Site 8 outside A,V. Williams Hall from 0828 to 0958 July 16, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

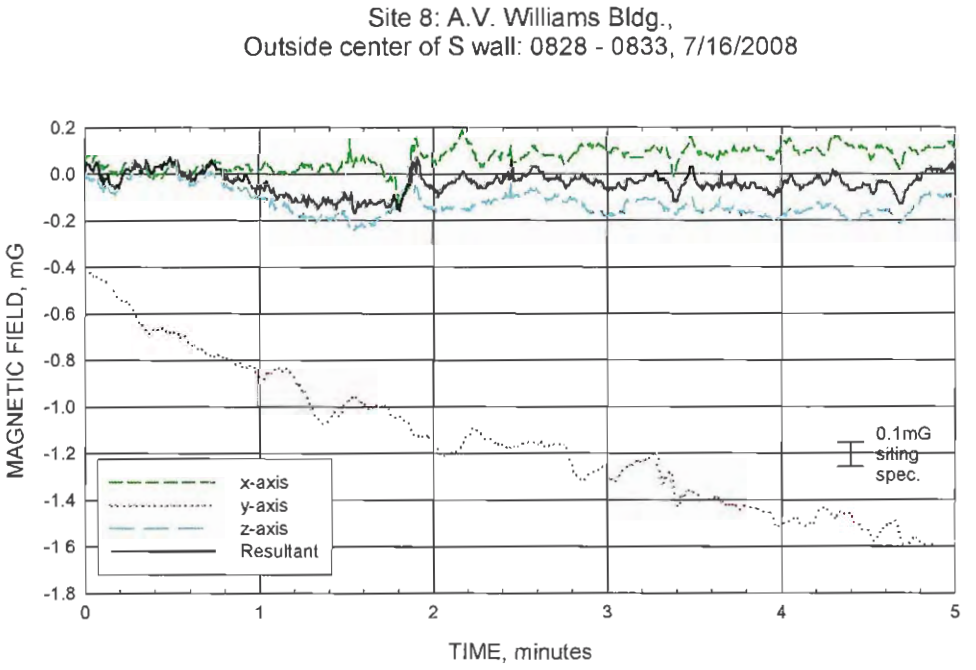
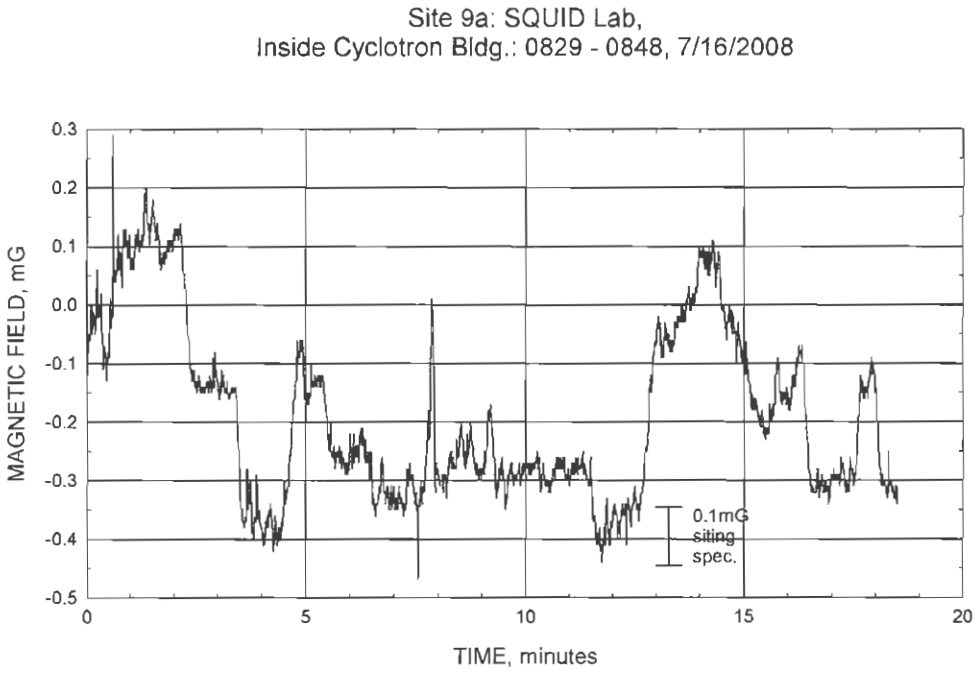


Figure 10: Total magnetic field measurements at Site 9a inside SQUID laboratory of old Cyclotron Building from 0829 to 0848 July 16, 2008: a) during 19-minute measurement period; and b) during first 5-minute period.

a) 19-minute measurement period



b) First 5-minute measurement period

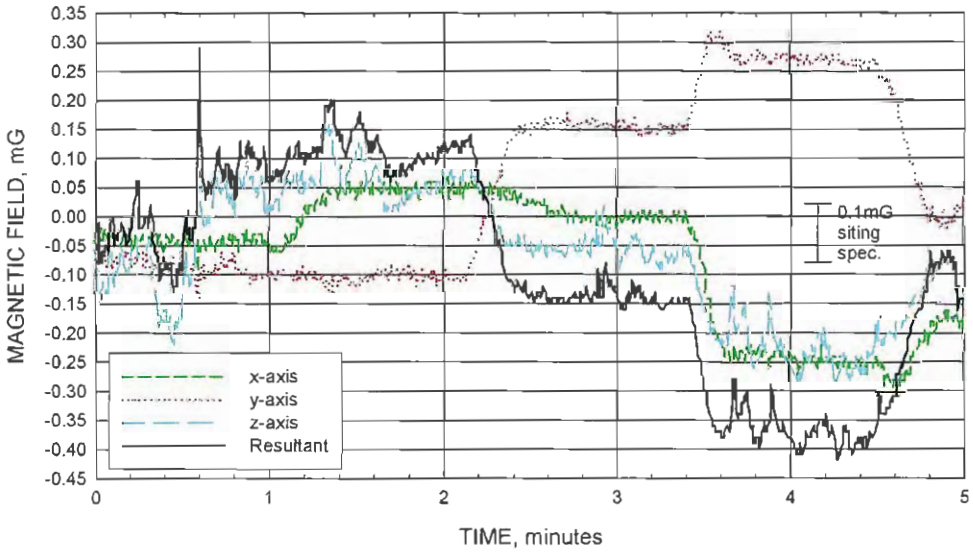
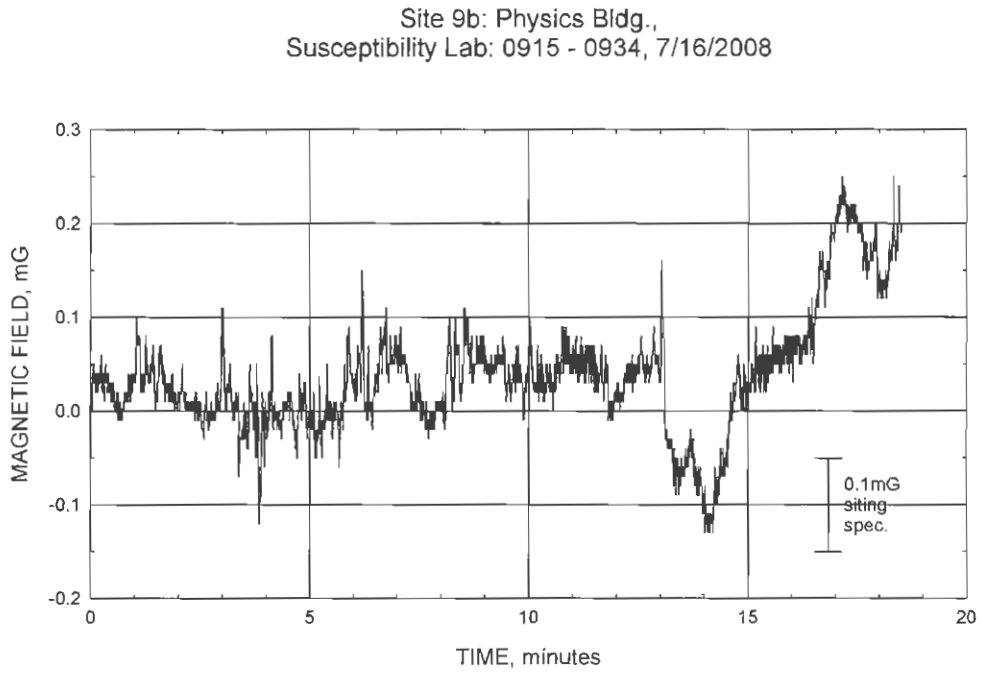


Figure 11: Total magnetic field measurements at Site 9b inside susceptibility laboratory of old Cyclotron Building from 0915 to 0934 July 16, 2008: a) during 19-minute measurement period; and b) during first 5-minute period.

a) 19-minute measurement period



b) First 5-minute measurement period

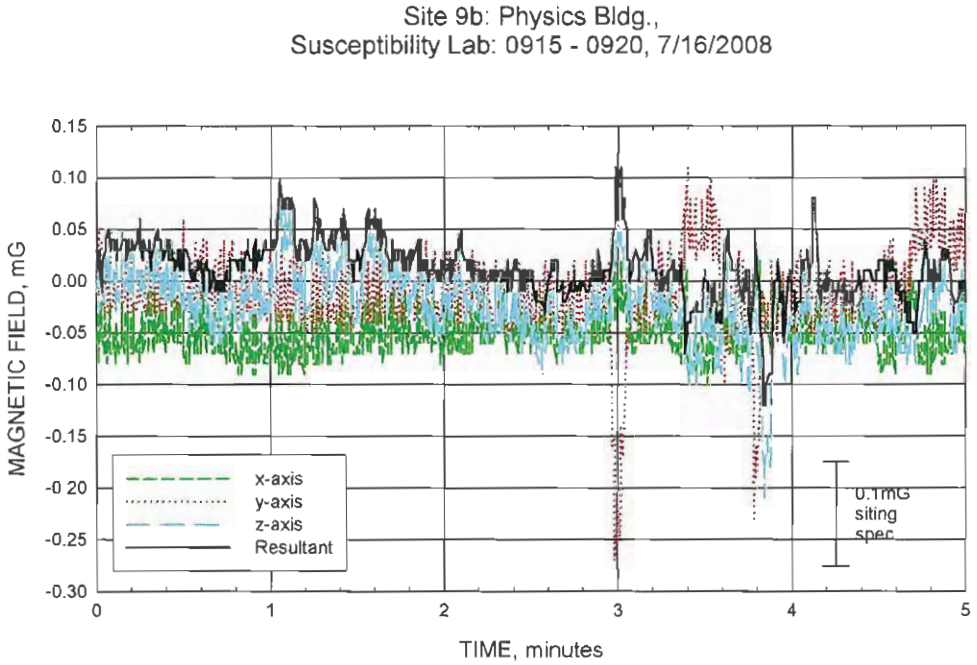
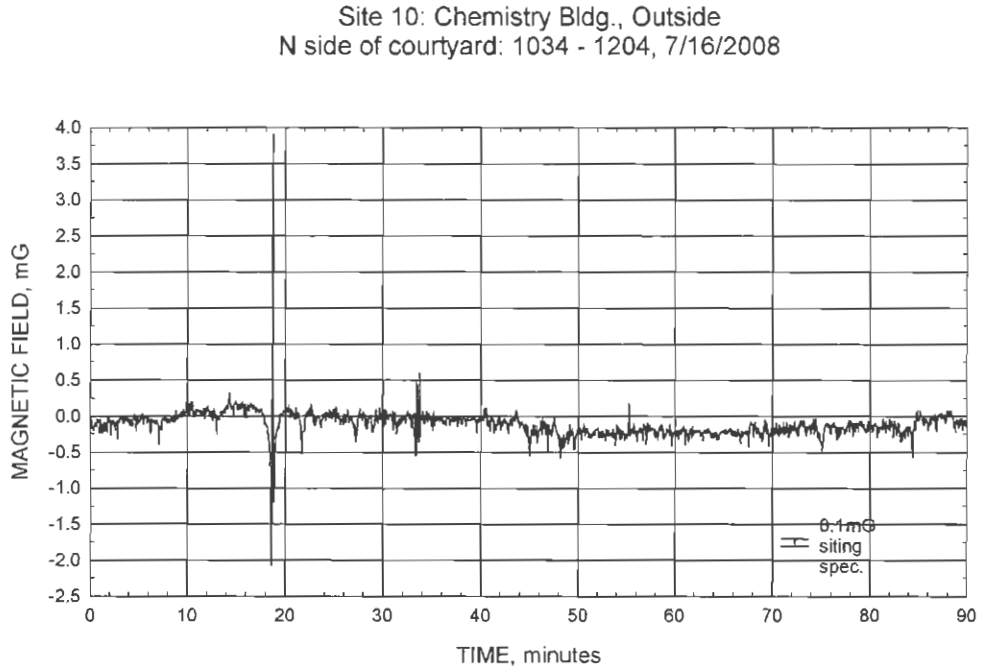


Figure 12: Total magnetic field measurements at Site 10 outside Chemistry Building from 1034 to 1204 July 16, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

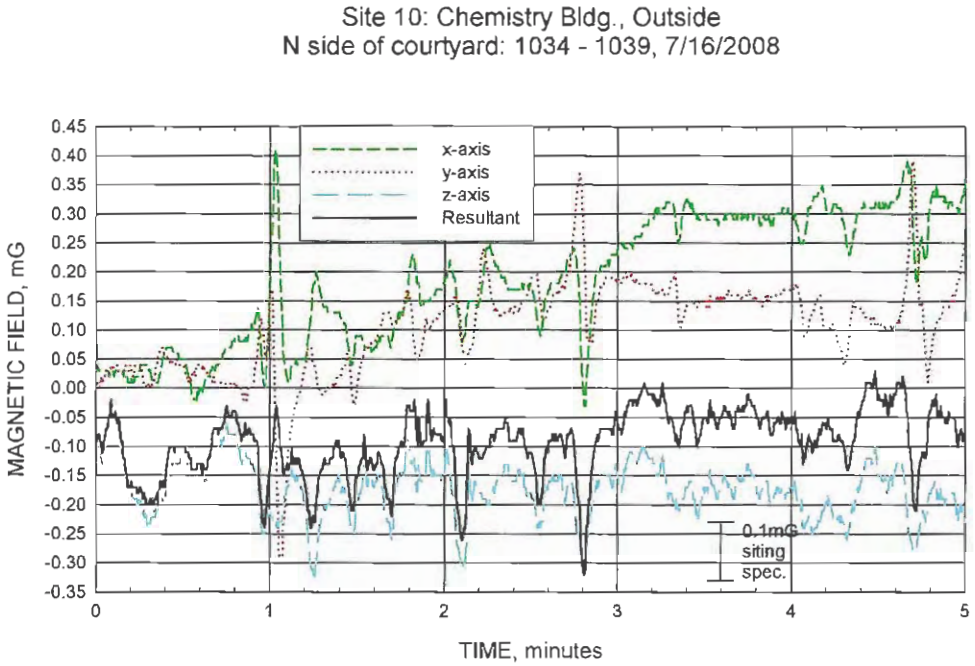
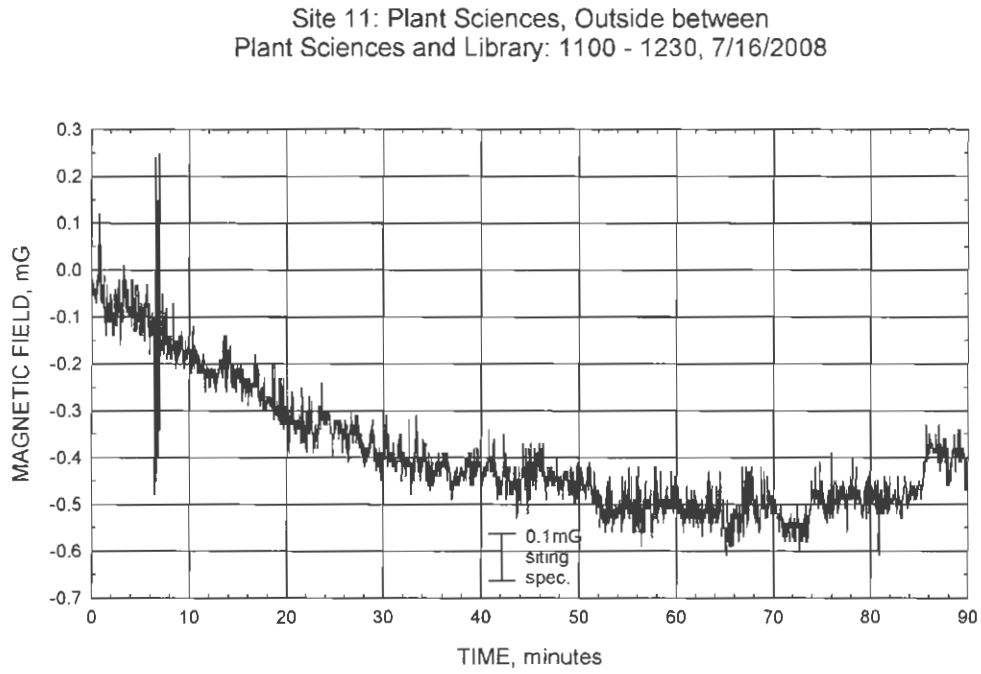


Figure 13: Total magnetic field measurements at Site 11 outside Plant Sciences Building from 1100 to 1230 July 16, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

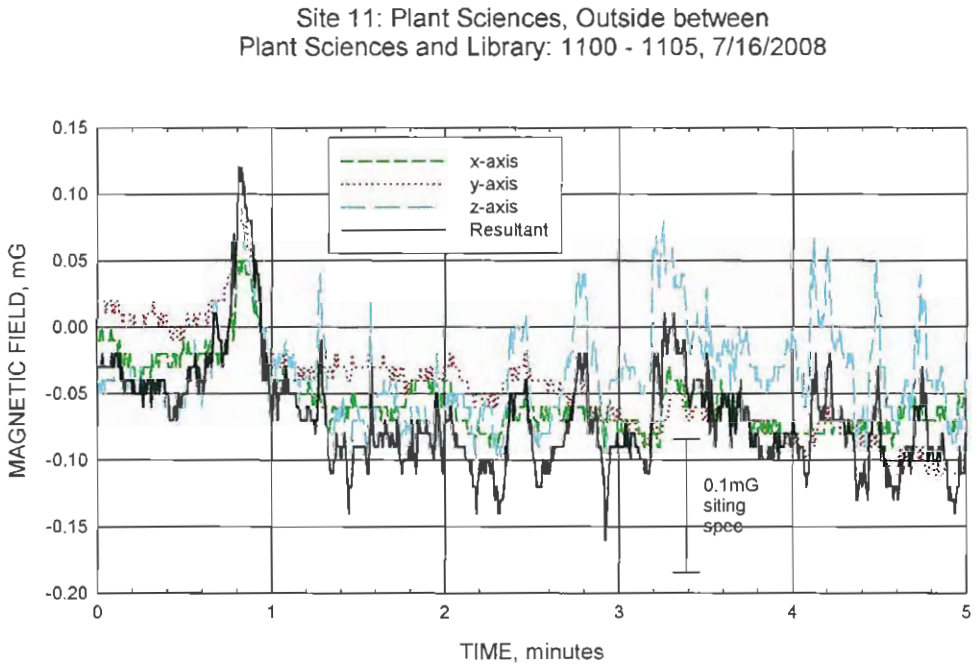
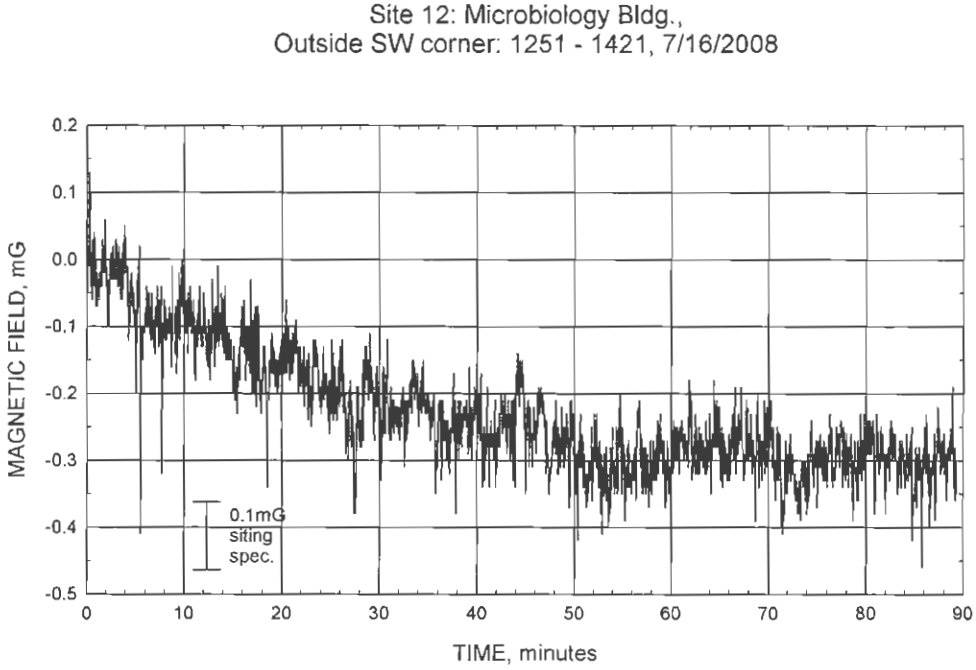


Figure 14: Total magnetic field measurements at Site 12 outside Microbiology Building from 1251 to 1421 July 16, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

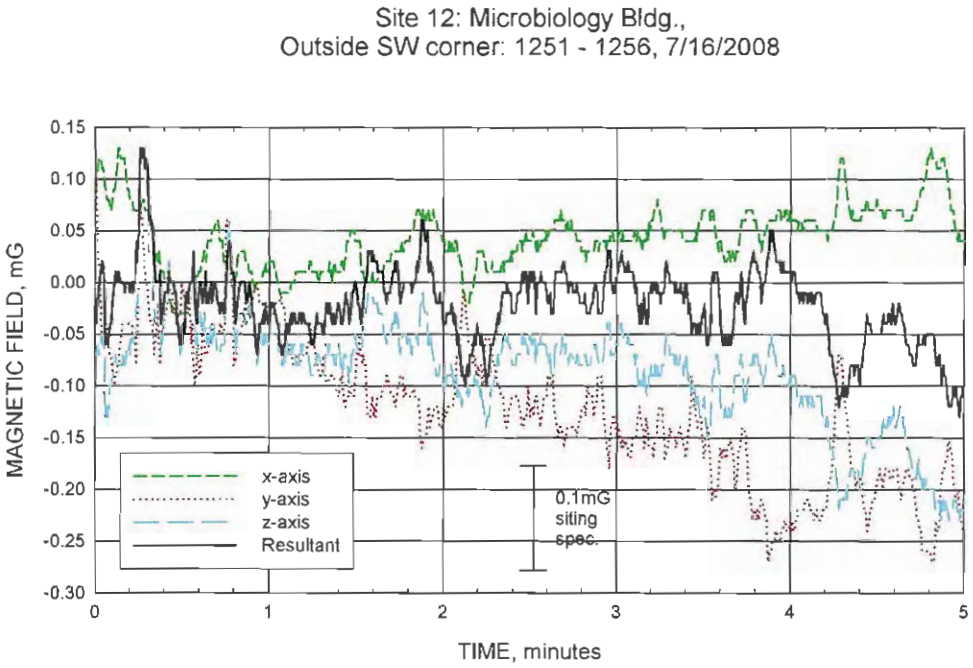
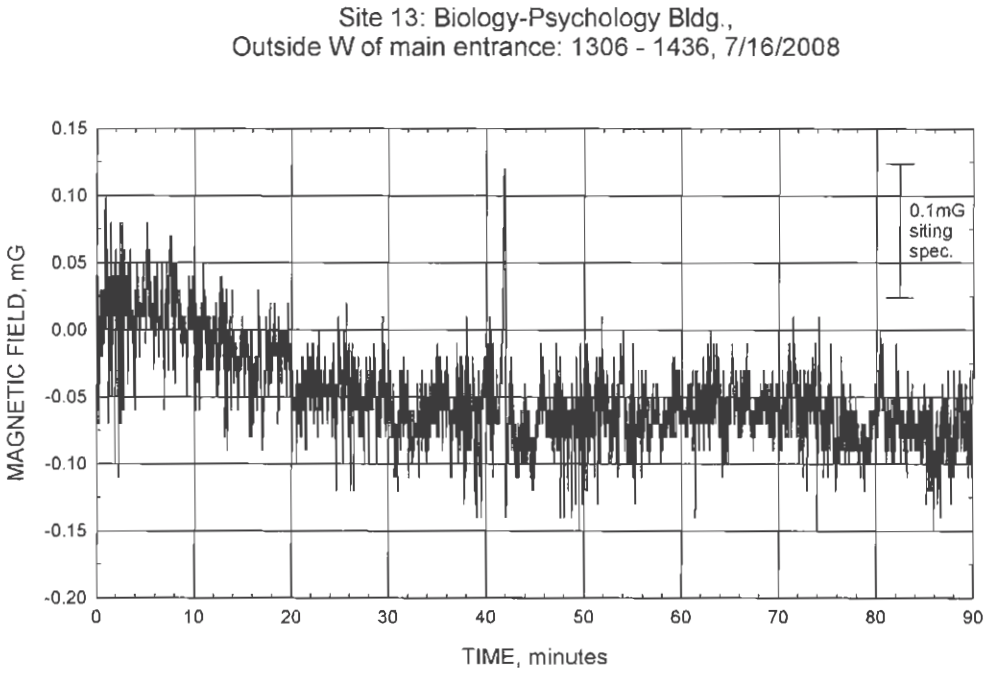


Figure 15: Total magnetic field measurements at Site 13 outside Biology-Psychology Building from 1306 to 1436 July 16, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

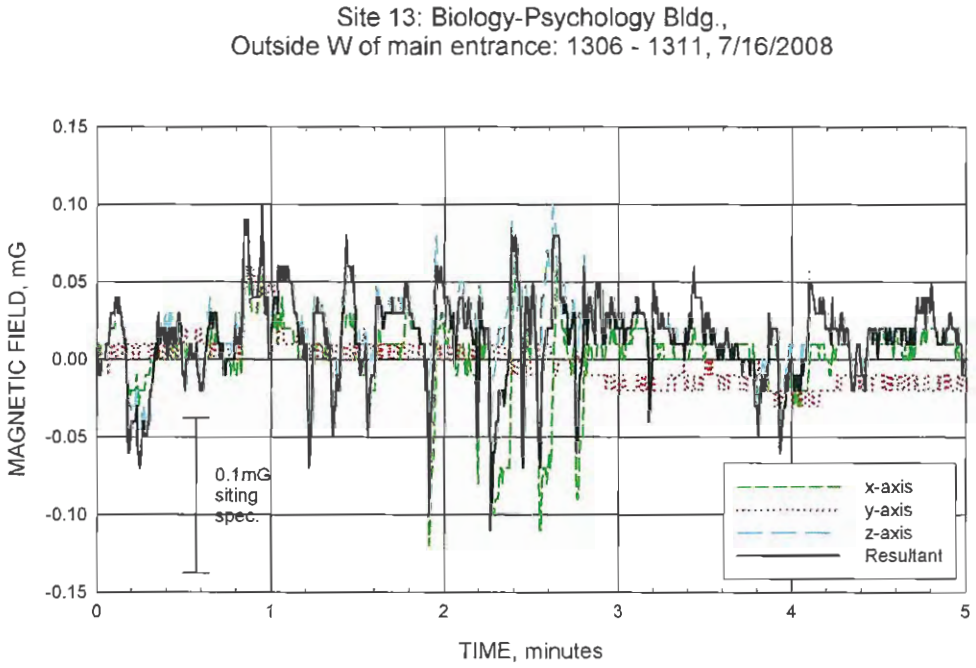
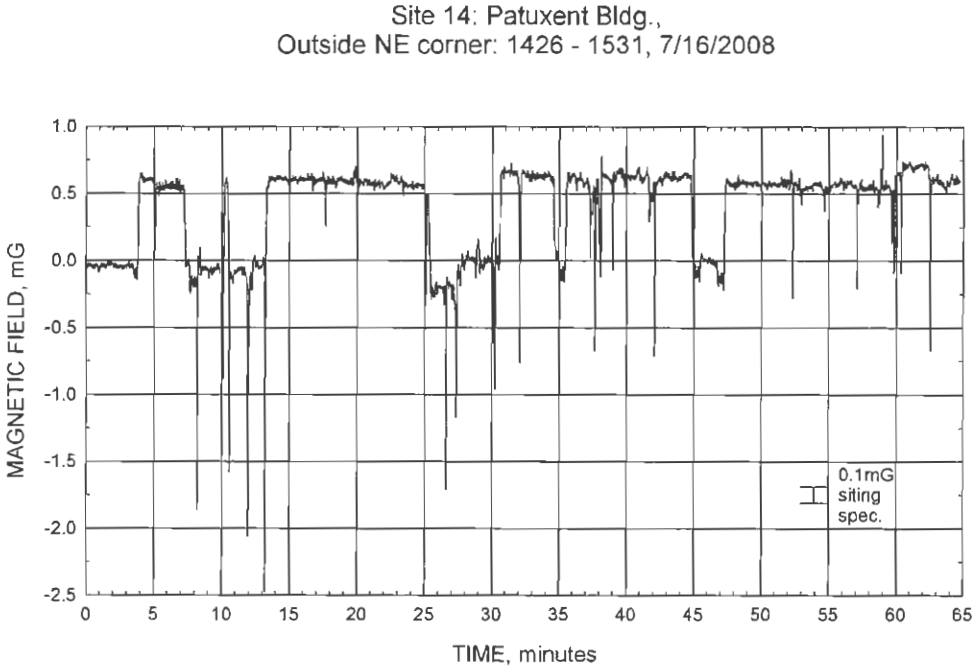


Figure 16: Total magnetic field measurements at Site 14 outside Patuxent Building from 1426 to 1531 July 16, 2008: a) during 90 minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

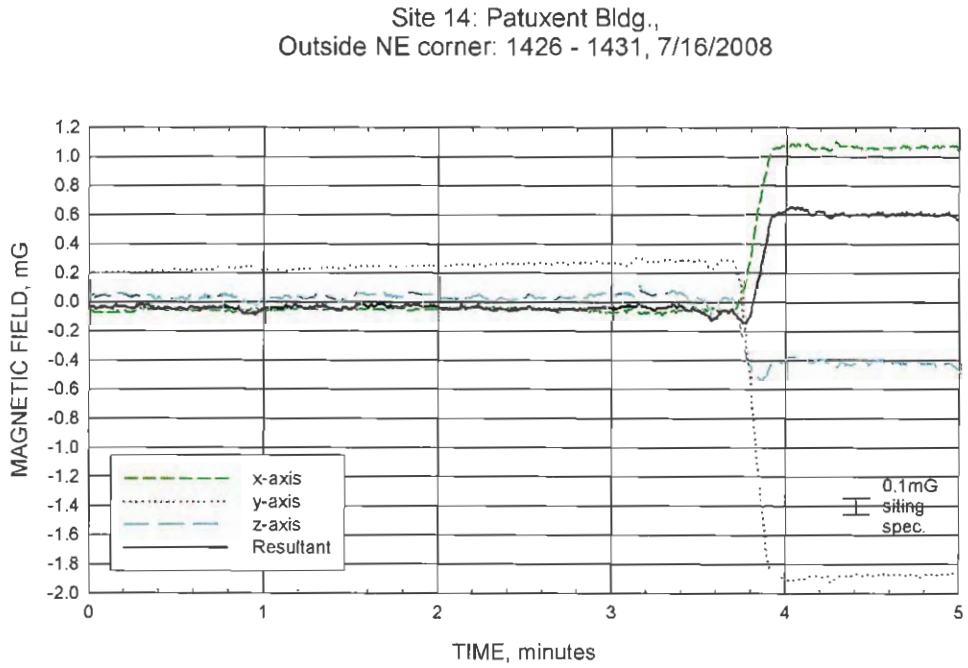
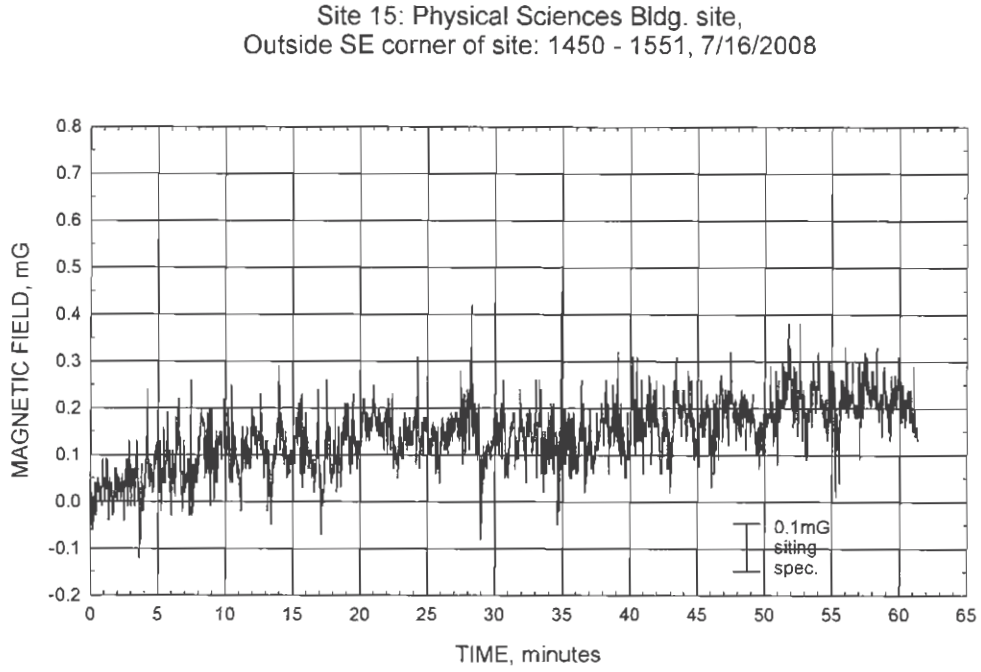


Figure 17: Total magnetic field measurements at Site 15 outside on Physical Sciences Building site from 1450 to 1551 July 16, 2008: a) during 60-minute measurement period; and b) during first 5-minute period.

a) 60-minute measurement period



b) First 5-minute measurement period

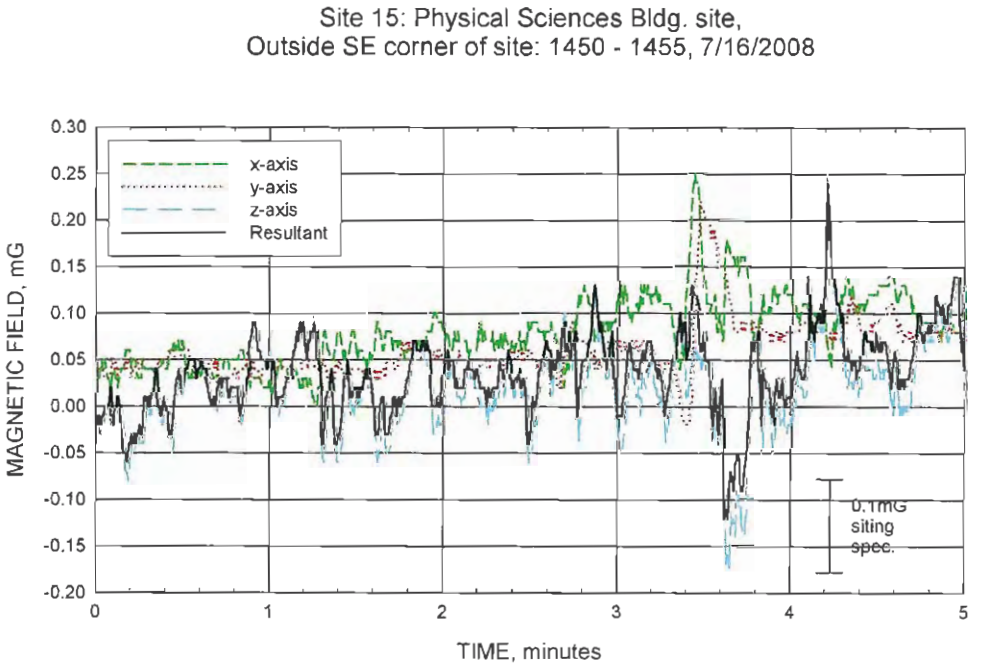
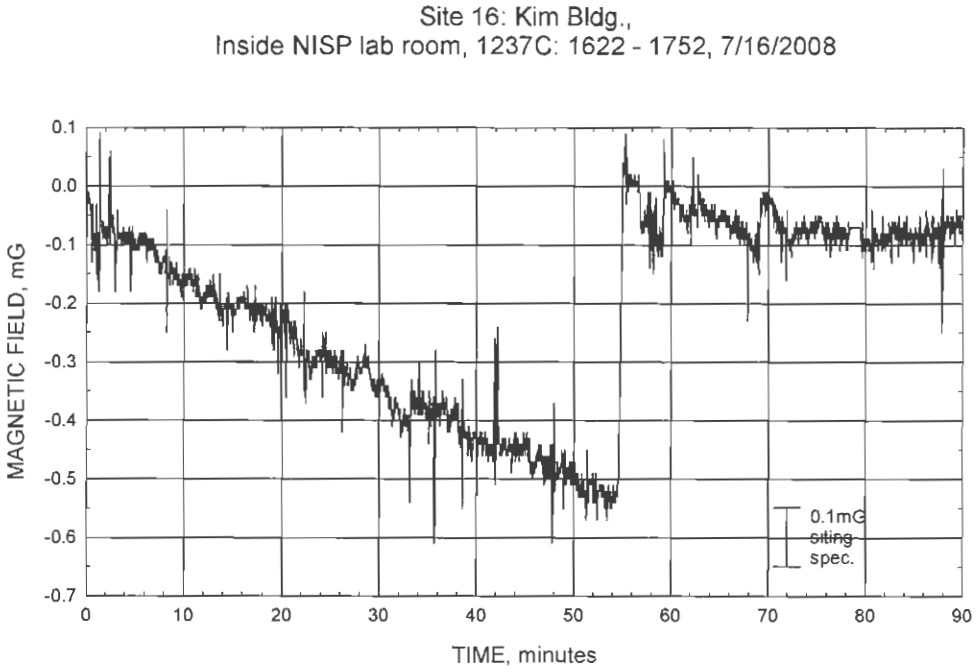


Figure 18: Total magnetic field measurements at Site 16 inside NISP laboratory in Kim Building from 1622 to 1752 July 16, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

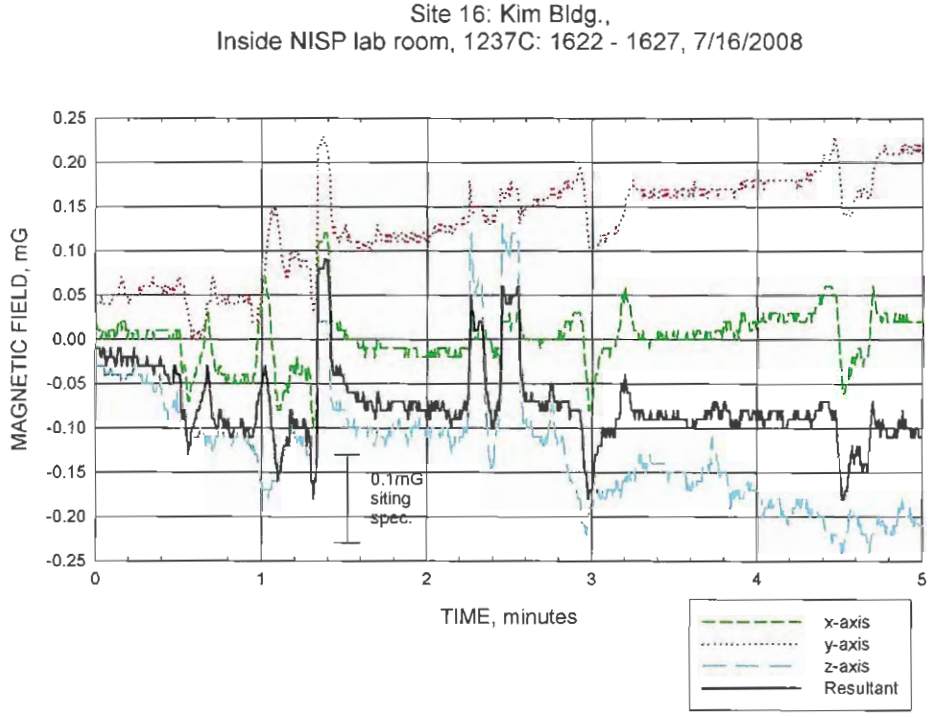
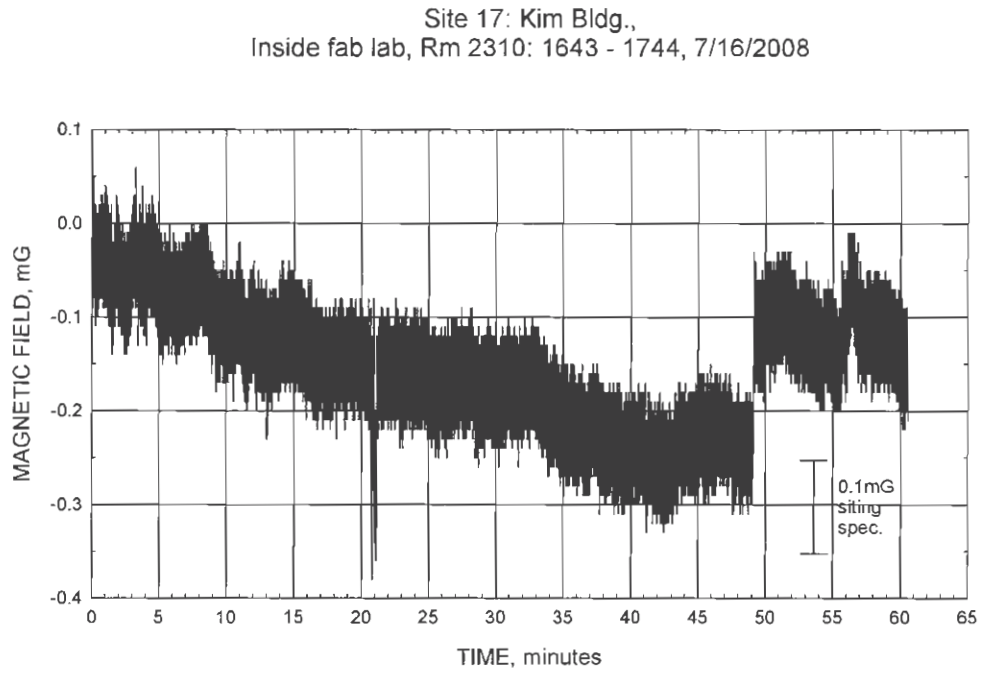


Figure 19: Total magnetic field measurements at Site 17 inside Fabrication laboratory in Kim Building from 1643 to 1744 July 16, 2008: a) during 60-minute measurement period; and b) during first 5-minute period.

a) 60-minute measurement period



b) First 5-minute measurement period

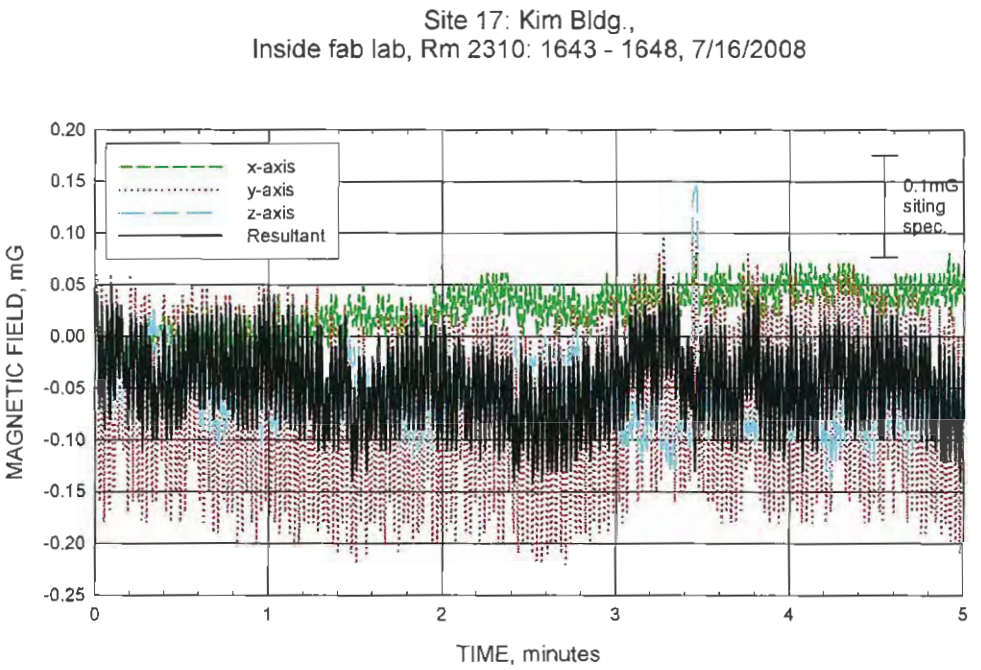
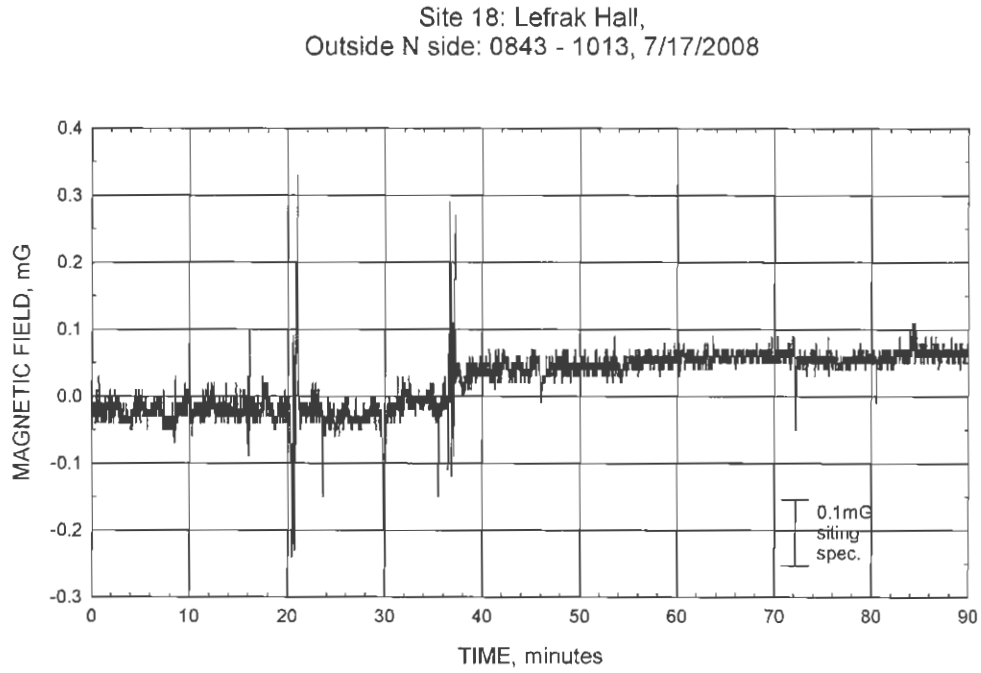


Figure 20: Total magnetic field measurements at Site 18 outside Leftrak Hall from 0843 to 1013 July 17, 2008: a) during 90-minute measurement period; and b) during first 5-minute period.

a) 90-minute measurement period



b) First 5-minute measurement period

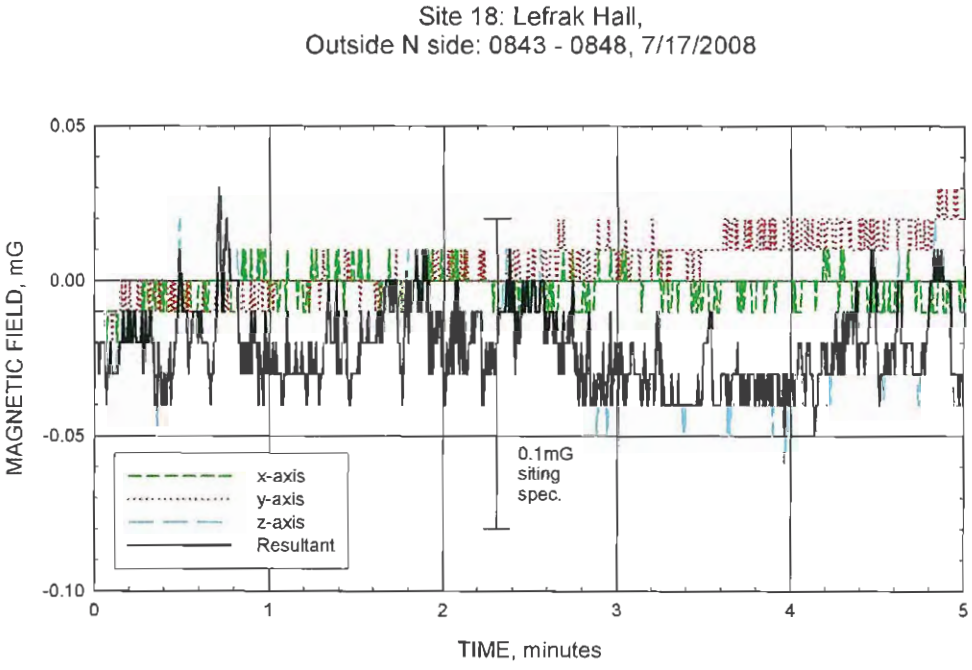
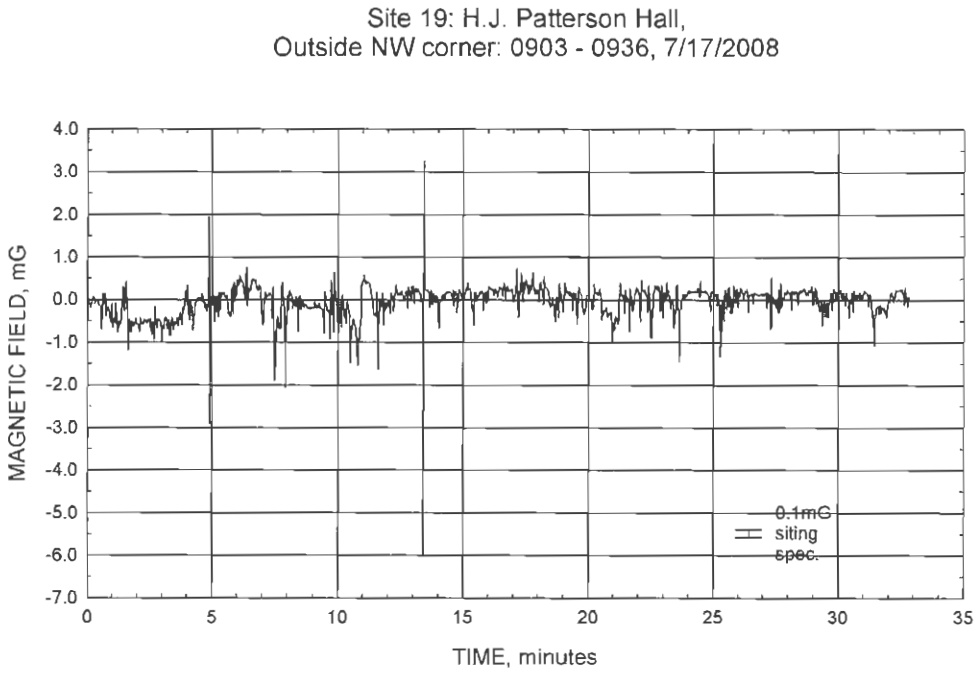


Figure 21: Total magnetic field measurements at Site 19 outside H. J. Patterson Hall from 0903 to 0936 July 17, 2008: a) during 33-minute measurement period; and b) during first 5-minute period.

a) 33-minute measurement period



b) First 5-minute measurement period

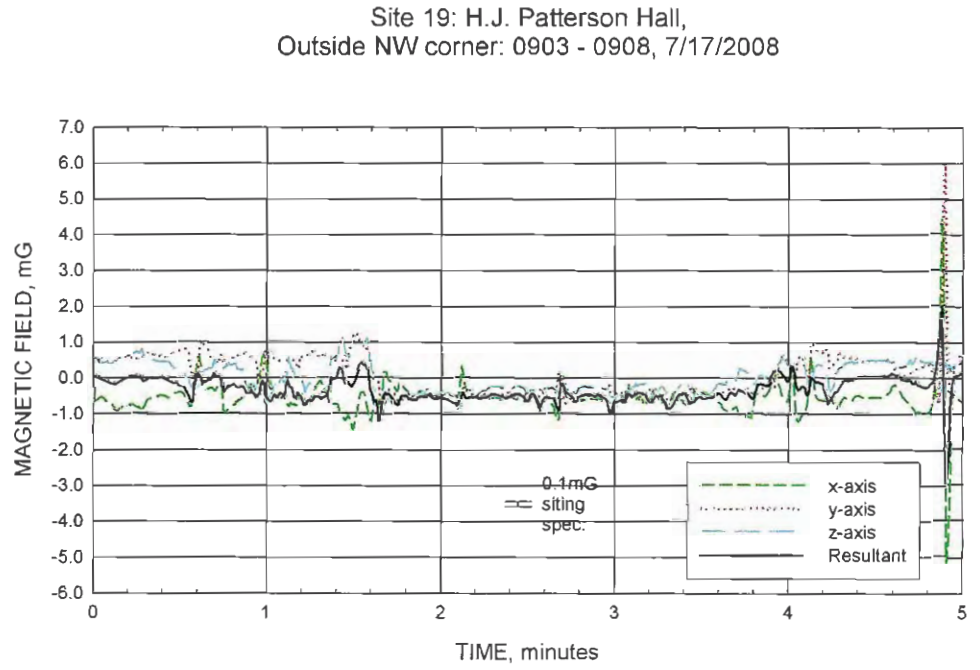
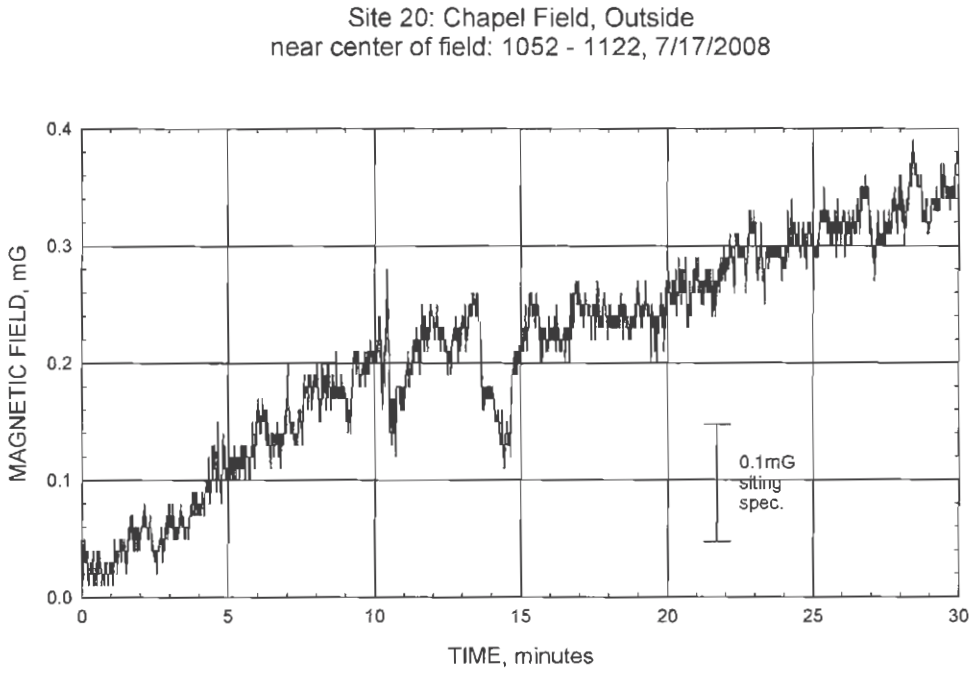


Figure 22: Total magnetic field measurements at Site 20 outside on Chapel Field from 1052 to 1122 July 17, 2008: a) during 30-minute measurement period; and b) during first 5-minute period.

a) 30-minute measurement period



b) First 5-minute measurement period

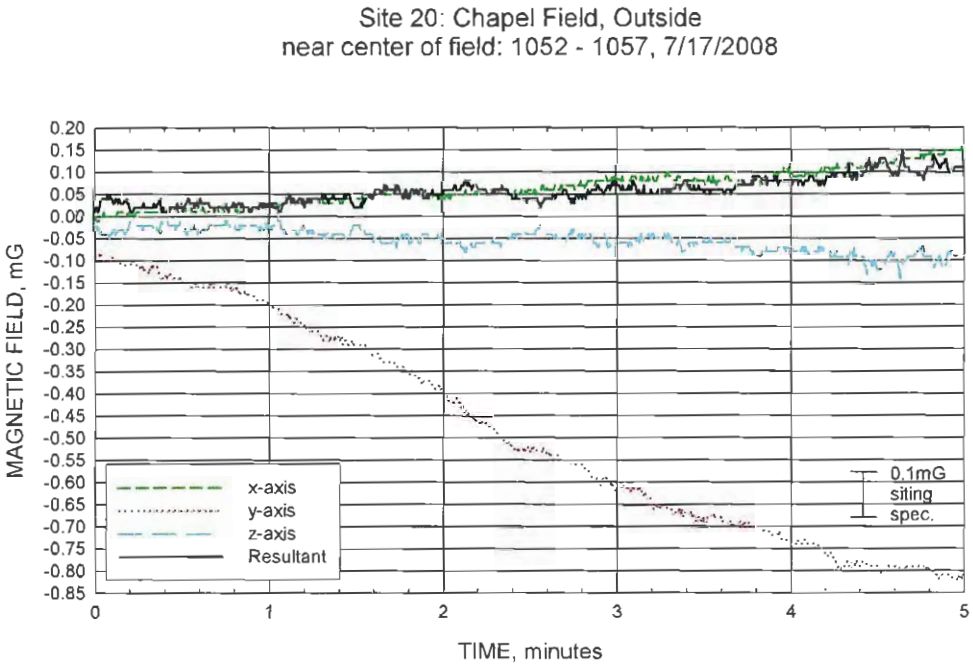
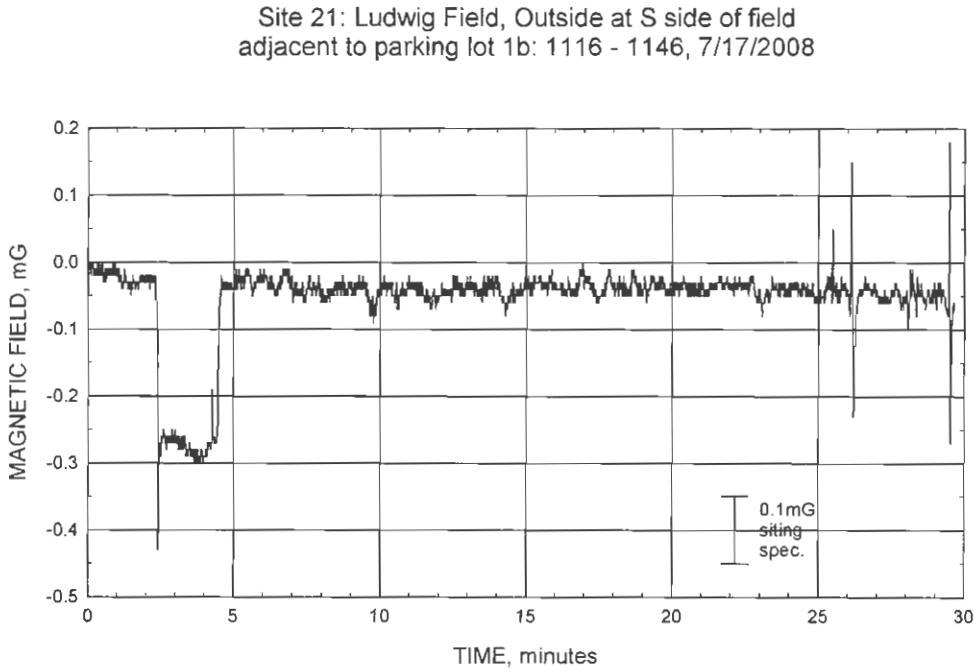


Figure 23: Total magnetic field measurements at Site 21 outside at Ludwig Field from 1116 to 1146 July 17, 2008: a) during 30-minute measurement period; and b) during first 5-minute period.

a) 30-minute measurement period



b) First 5-minute measurement period

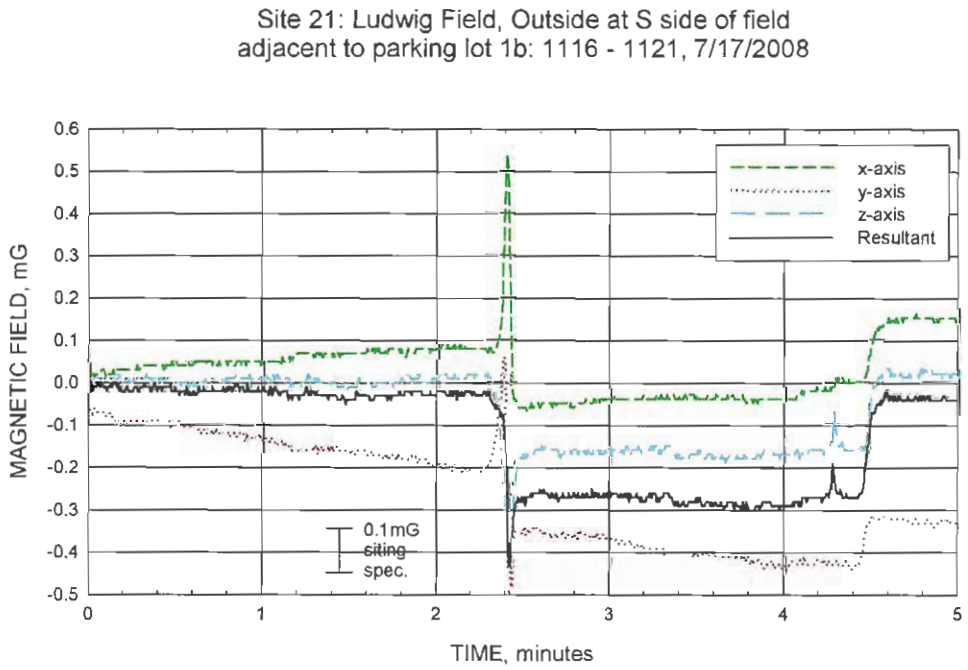
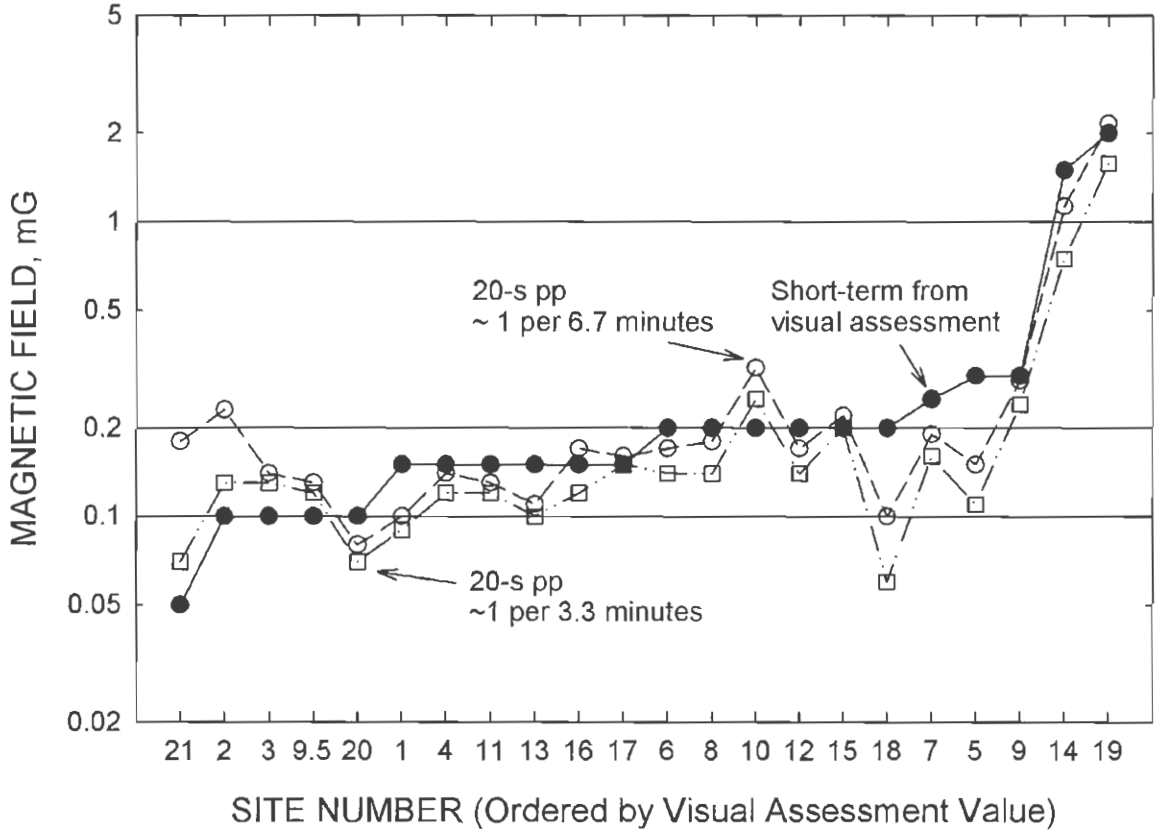


Figure 24: Background Magnetic Field Fluctuations by Summary Measure by Site.



UNIVERSITY OF
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February 3, 2009

Ms. Diane Ratcliff
MTA Director of Planning
6 St. Paul Street, 9th Floor
Baltimore, MD 21202

Dear Ms. Ratliff:

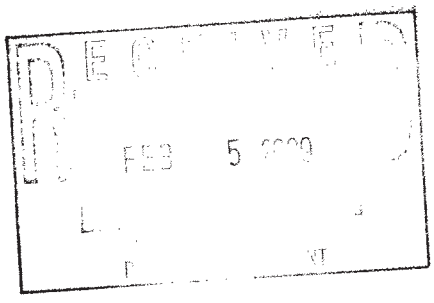
Please consider the attached as an addendum to the University of Maryland's comments on the Purple Line Project Alternatives Analysis/Draft Environmental Impact Statement.

Sincerely,

Ann G. Wylie
Interim Vice President
for Administrative Affairs

Enclosure

cc: C. D. Mote, Jr. President, University of Maryland
William E. Kirwan, Chancellor, University of Maryland
Clifford M. Kendall, Chairman, Board of Regents, University System of Maryland
Kenneth G. Holum, Chair, University Senate
Jonathan Sachs, President, Student Government Association
Anupama Kothari, President, Graduate Student Government



Addendum to University of Maryland comments on Draft EIS

The comments we provided in early January indicated that research dependent on sensitive instruments on the College Park campus was significant, but we did not provide a measure of the extent of the research, such as the number of people involved, or the magnitude of the research dollars that support this type of work. While it is not possible to provide a complete picture, we have attempted to capture data that describe a number of significant efforts. In addition, in our comments we asserted that the sensitivity of instruments has increased over time, and we are submitting evidence to support that statement.

Research Dependent on Sensitive Instrumentation

We have asked three major centers of research that use sensitive instruments to provide an assessment of the scope of this work. The following provides an overview.

A. **Maryland NanoCenter**. It is estimated that 500 individuals use the sensitive instruments located in the NanoCenter's FabLab or NISPLab. Most of these are students and faculty from the University, but the facilities are open to other researchers, and there are about 50 users annually form neighboring universities, companies and government labs. There are 8 courses offered each year that use these instruments in laboratory exercise and it is estimated that about 200 students are enrolled annually. Research support in the amount of about $33M/year is received that is dependent on these instruments and at any one time there is about $122M in place. It is estimated that grant awards involving sensitive instruments will rise from the current level of $33M in FY08 to $50M in five years and $125M in 15 years. Twenty years ago, the grants would have been in the $5M range.

B. **College of Chemical and Life Sciences**. The Department of Biology has four electron microscopes and a new laser-scanning 2-photon confocal microscope. In 2008, the electron microscopes were used by about 120 faculty and students supported by about $12M in research grants. Twenty years ago, there were only two electron microscopes in the department used by about 20 faculty and students with $1.3M in funding. The confocal facility is used by about 6 faculty and students whose research is supported by about $2.5M. The Department did not have such a facility twenty years ago. The Department of Cell Biology and Molecular Genetics has vibration sensitive equipment in the Microbiology, Biosciences Research and H.J. Patterson Buildings. The instruments are used by approximately 110 people annually and the research is funded at about $5M. In the coming years, the department believes there will be the addition of an STEM. The Department of Chemistry and Biochemistry has more than 16 sensitive instruments including nuclear magnetic resonance, atomic force microscopes and laser instruments. They are used by about 28 faculty, 120 graduate students, 210 undergraduate students and 28 post docs. There are 38 grants funding the work

for a total of $4.9M. The department anticipates the addition of similar instruments of even higher sensitivity during the upcoming five years as the sciences move further into the realms of bio and nano-technology.

C. **Department of Physics**. The Department of Physics has a number of researchers with many different projects and one course that use sensitive instrumentation, including electron microscopes, atomic force microscopes, scanning tunneling microscopes, laser interferometers, gravity gradiometers, nuclear magnetic resonance, and self-constructed experimental apparatus. The research funding that is currently in place supporting the use of such instrumentation is about $63M and involves about 55 faculty and graduate students. The vast majority of this work did not go on at all twenty years ago. One course is under development that will incorporate nuclear magnetic resonance spectrometry in the laboratory. The course currently has 4 students per year but will grow to about 58 when the module is fully developed.

In summary, in these three areas of research, there are more than 1100 faculty, students and visitors who use sensitive instruments on the campus annually. The work is funded by grants that today total almost $210 million dollars.

Measure of the Sensitivity of Instrumentation through Time

Not only does the growth of funding for research dependent on sensitive instrumentation reflect the growing dependence on quiet environments, but the specifications of the instruments and environments also show the march toward increasing sensitivity.

A. **Electron microscopes**. We asked JEOL, a major manufacturer of scanning and transmission electron microscopes, about how sensitivity has changed over the past twenty years. They replied as follows: "While researching the archives for the older information (on sensitivity), I learned that many of our older specifications had been updated and tightened. It turns out that as we have become more expert at relating instrument performance to room conditions, it was necessary to revise the specifications. At the same time, customer requirements for acceptable levels of noise and distortion in the proof of performance data have also required tighter specs for the room. Since we are occasionally asked to install or move older instruments, it became important to have accurate specifications. I am unable to provide the original documents since we no longer consider them accurate." As we indicated in our testimony, many electron beam instrument now require EMI to be 0.1Mgauss or less and vibration below the level of VC-E.

B. **Vibration Standards**. The VC standards define levels of vibration. They were developed in the early 1980's. Today, they are curated by the Institute of Environmental Science and Technology, and they are accepted by the American Society of Civil Engineers, the American Society of Mechanical Engineers, the Society of Photo-Optical Instrumentation Engineers and the American Institute of

Steel Construction. The VC-E curve was the "quietest" VC curve until late 2007 when it became clear that the VC curves needed to be extended to address the needs of research environments. In 2007, the VC-F and VC-G curves were added. There have been about a three orders-of-magnitude change in vibration criteria since people started thinking about these issues in the late 1970's, reflecting the ever increasing demands of research. The NIST-A criterion is more demanding than the quietist VC-G curve in the frequencies below 10 Hertz, but rises to between VC-E and VC-F from 10 to 100Hertz. It was the result of a low vibration design for a NIST building constructed in the late 1990's and defined by the performance of that building. The new physical Sciences Complex and new laboratories at the Laboratory for Physical Sciences are being constructed to that standard.

- RECORD #1179 DETAIL

First Name :	Ann, Colin, & Steve
Last Name :	Wylie,Phillips & Ralston
Business Name :	University of Maryland
Address :	
City :	
State :	MD
Zip Code :	
Email Address :	

Submission Content/Notes : Yes, I'm Ann Wylie. W-Y-L-I-E. I'm joined by Steve Rolston, R-O-L-S-T-O-N and Colin Phillips, C-O-L-I-N, P-H-I-L-L-I- P-S.

The purple line will provide for the University accessible regional connections for the members of our community. It will assist our East campus initiative and it will enable the university to reduce its carbon footprint.

For these reasons, we strongly support the construction of the purple line.

However, the DEIS has not addressed the impact of the train on the research enterprise of the University and it is to this topic which we wish to speak today.

By any measure, the University is a research powerhouse. About 1/3 of our more than a billion dollar budget comes from external funds dedicated to research.

Research on the order of $400 million a year to a university without a medical school places us among the elite in the nation.

Our largest funder is the Department of Defense. The University has forged partnerships with federal labs such as NASA/Goddard, NIH and NOA which extends our research influence in the country's research enterprise.

Our growing partnership with NIS, for example, has enabled the National Science Foundation to designate our joint quantum institute as a frontiers in physics center, one of only ten in the nation.

As a leading research university, the role that we play in the state cannot be overstated. Not only does our research expand knowledge, it draws talent to the state and our graduates trained in the latest research techniques and state-of-the-art equipment find employment in the research enterprise that thrives in the State of Maryland.

Much of the innovative and path-breaking scientific research and training that we do involves equipment that is extraordinarily sensitive and will only function in a very quiet environment that we currently enjoy.

The effects of rapid mass transit include both vibration and magnetic field fluctuations that exceed the specifications of equipment currently on the market and will affect experiments that we perform and thereby have the potential to negatively and irretrievably impact our current and future research environment.

I am joined today by two professors from the University who will discuss this in more detail.

MR. PHILLIPS: But briefly looking at the time. I'm Collin Phillips. I'm a Professor in Linguistics in the Neuroscience Program, and my charge is to describe the impacts of electromagnetic interference sometimes called just EMI on research at the University.

So why does light rail create electromagnetic interference? There are two main sources.

First, trains are very large metal objects up to about 180 feet long that will move through the campus at 10 to 15 miles an hour. This distorts the earth's magnetic field everywhere near the train.

Second, the trains are powered by strong electrical currents in wires along the routes and where there are strong electrical currents, there are strong magnetic fields.

Why do we care about this? We care a lot because a quiet electromagnetic environment is crucial for a lot of the cutting edge research being done at the University.

It is essential for things like electromycroscopy, low temperature physics, nuclear magnetic resonance imaging, biomagnetic brain recordings, to name a few.

Currently we have a very quiet electromagnetic environment. The University commissioned a study over the summer and measured 22 locations and almost all of them have a very low magnetic level around.1 to.2 mili (inaudible)

What difference would light rail make? From damaging to devastating depending on the site, spreading areas up to 300 feet on either side of the track, potentially taking out an 80-acre swath of the campus.

In some areas it would increase levels from.05 miligouse to 30 miligouse. That's like trying to record a quiet conversation standing next to a jackhammer.

These instruments (inaudible) weigh tons and are in special structures. We are also worried because electromagnetic interference receives zero mention in the DIS statement, and therefore we think it's very important that this be addressed.

MR. RALSTON: I'm Steve Ralston, Professor of Physics and Director of the Joint Quantum Institute.

The vibration levels discussed in the DEIS are orders of magnitude higher than we need for our research. More appropriate to deciding whether a building shakes or not.

The research and architectural communities have developed vibration standards for research buildings that are much more stringent than those in the DEIS.

As an example, a recent standard referred to as (inaudible) as developed in the process of constructing a lab mist and has been adopted as the design standard for the new physical sciences complex under design for the northen part of campus.

Concerns about potential impact from light rail on campus led the University to hire a consultant to study vibration. Preliminary results show that the campus is exceptionally quiet in terms of vibration with most locations meeting this day's standards.

As part of the environmental impact study, it's necessary for the state to acknowledge these unique conditions and requirements. This may impact choice of alignment as well as track and train design, construction and maintenance.

The University looks forward to working with the state to address these issues so that the University can continue in its role as a national leader in research.

- RECORD #3193 DETAIL

First Name :	Nat
Last Name :	Bottigheimer
Business Name :	Assistant General Manager, WMATA
Address :	Planning and Joint Development
City :	
State :	MD
Zip Code :	
Email Address :	
Submission Content/Notes :	
Attachments :	WMATA.pdf (520 kb)

January 12, 2009

Diane Ratcliff
Director, Office of Planning
Maryland Transit Administration
6 St. Paul Street, 9th Floor
Baltimore, MD 21202

Re: Purple Line AA/DEIS Comments

Dear Ms. Ratcliff:

The Washington Metropolitan Area Transit Authority (WMATA) appreciates the opportunity to provide comments on the Purple Line Alternatives Analysis and Draft Environmental Impact Statement (AA/DEIS). As the regional transit operator in the Washington metropolitan area, WMATA supports the efforts of the Maryland Transit Administration (MTA) to expand transit service in the Purple Line corridor and improve the quality of life for metropolitan area residents and visitors. We hope these staff comments provide valuable feedback and we look forward to further participation in this important project.

The Purple Line will provide a high-quality east-west transit service connecting rapidly developing activity centers and neighborhoods in Prince George's and Montgomery counties. Whether the final preferred alternative is Bus Rapid Transit (BRT) or Light Rail Transit (LRT), there are a number of benefits of the Purple Line that we would like to highlight:

- **Regional Transit Connectivity**. The Purple Line connects four radial branches of the Metrorail system providing better transit system connectivity. The increased connectivity could benefit Metrorail passengers by providing more travel alternatives, particularly in the event of disruptions in the core of the system.

- **Dedicated Right-of-Way for Transit**. Traffic congestion on suburban roadways has a significant impact on the ability of Metrobus to deliver rapid and reliable service. Travel delays increase bus operating costs as well as the fleet requirements for the bus system. WMATA strongly supports the alternatives that provides more dedicated right-of-way and priority treatments for transit vehicles.

Washington Metropolitan Area Transit Authority

600 Fifth Street, NW
Washington, DC 20001
202/962-1234

By Metrorail:
Judiciary Square—Red Line
Gallery Place-Chinatown—Red, Green and Yellow Lines
By Metrobus:
Routes D1, D3, D6, P6, 70, 71, 80, X2

A District of Columbia, Maryland and Virginia Transit Partnership

- **Core Capacity Relief**. The Metrorail system experiences crowded congestions during the peak travel period. Forecasts of future ridership indicate continued growth that will place demands on the capacity of the system, especially for transfers at the major downtown stations. By allowing for direct intra-suburban trips on high-quality rapid transit, the project will likely carry some transit trips that otherwise would have travelled through the core of the Metrorail system either on the Red Line or to transfer to the Green Line or Orange Line.

As designs for the project progress further in the preliminary engineering phase, there are some considerations that we feel are critical to the project's success:

- **Pedestrian Safety and Accessibility.** While there appear to be no significant safety impacts inherent in the overall project scope, for any alignment chosen, the future facility must be designed to ensure safe movement for pedestrian and vehicular traffic in the corridor. The Metro system is one of the few fully accessible transit systems in the country. Modal connections to and from Metrobus and or Metrorail to either the new BRT or LRT service must be made fully accessible. WMATA is currently updating the Station Site and Access Planning Manual to include BRT/LRT access guidelines to ensure pedestrian safety, bus access, and ADA compliance in the vicinity of Metrorail stations. The Purple Line will need to be designed to comply with these guidelines.

- **Regional Integration of Transit Services.** It is critical that the Purple Line be designed and operated in a manner that provides transit riders with easy-to-use service and seamless transfers between the Purple Line and Metrorail and Metrobus. Integration should consider:

    - *Fare Policies and Technology*. Nearly all bus systems in the region are equipped with SmarTrip capability for fare payment. WMATA now only provides transfer discounts to passengers using SmarTrip cards. It is important that the Purple Line fully utilize the SmarTrip card, and allow passengers the greatest ease in transferring to and from other transit lines.

- *Customer Information Integration*. The capability to exchange information on vehicle location, arrival times and service disruptions improves customers' experience and confidence in using transit. A seamless integration of wayfinding signs, transit system maps, and other electronic traveler information with WMATA and other existing local transit services will be essential to the incorporation of the Purple Line into the existing transit network.

- *Mode Technology*. Given the regional nature of the project, MTA should seek out opportunities to integrate the selected mode, whether BRT or LRT, with other regional transit projects. For a BRT system, that could entail shared bus storage and maintenance facilities. For a LRT system, the project design and development should be coordinated with other LRT and streetcar projects being explored in the District of Columbia and Virginia to avoid inefficiencies related to different vehicle technologies, workforce training, maintenance yards, or lack of inter-connections.

We look forward to continued coordination with MTA on the next phases of this project. If you have any questions regarding these comments, please direct them to Mr. John Magarelli of our staff at (202) 962-1357.

Sincerely,

Nat Bottigheimer
Assistant General Manager
Planning and Joint Development

Enclosure

Attachment A
Specific WMATA Comments and Questions on the Purple Line AA/DEIS

College Park Station

- The document states (Sections 2.4.4 and 2.4.5) that the BRT (Low and Medium Investment Alternatives) would enter the station site via the bus loop from River Road. Further coordination with WMATA is required in order to analyze the capacity of the Metro bus facility as a shared use if either of these alternatives is selected.

- A new station entrance could provide more direct access to and from the new passenger platform and the station. Will a new entrance be considered and incorporated into the project?

New Carrollton Station

- It is unclear how the BRT alternatives would enter the station site. Would the existing bus loop be a shared facility?

- Please clarify how the BRT/LRT alternatives will impact the existing surface parking, Kiss & Ride and Park and Ride lots.

Design

- WMATA has previously developed *Tram/LRT Guideline Design Criteria that* include a guideline that the maximum grade at passenger platforms is 0.35% for aerial structures and tunnels. The proposed grades indicated in the Conceptual Plans for stations at Adelphi, SSTC, Manchester Place, Takoma/Langley, and UMD Campus Center exceed these maximum grades.

- For capital and operating cost estimation, what types of materials are proposed to be used to build and construct the alignment? For example, if a concrete or composite railroad tie is used in lieu of traditional wood tie, the lifecycle use could double. For power sub-stations, the choice between diode or thyristor technology could affect operating costs. Design decisions should consider the lifecycle of the project. Sometimes a minimal increase in the upfront capital costs can lead to a significant reduction in long-term operating costs.

- Will the overhead catenary system (OCS) be a trolley wire configuration or a messenger/contact OCS configuration?

- What is the expected maximum operating speed of the system? (average speed indicated but not maximum). If system maximum speed is not above 45mph, will other modes of rail be considered? For example traditional light rail cars operate in 55 to 65 mph stretches of the alignment. If the system is in the maximum range of 45mph based on the alignments provided in the packet, a multi-module tram might be the better application for this alignment.

- If grade crossings are present will quad-gates be utilized? If grade crossings are present will pedestrian gates be utilized?

- What will be the location of the power source, stand alone installations from electric companies or will the project be seeking to tie into WMATA utilities?

Operations

- What are the planned operating hours? What is the expected headway during peak and off-peak revenue periods? Consistent operating hours and frequency between the Purple Line and Metrorail will ensure seamless travel on the regional transit system.

- The AA/DEIS describes off-vehicle payment based on enforcement – how will that work for passengers transferring from Metrorail who have paid with a SmarTrip card.